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SCIENTIFIC AMERICAN

Forcing the Dardanelles. A battle between land and naval guns. How Submarines are handled. Pictures from the front.

Vol. CXII. No. 14
April 3, 1915

Munn & Co., Inc., Publishers
New York, N. Y.

Price 15 Cents
$3.00 A Year

Ask the Steel Man

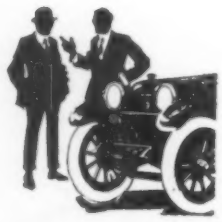
What manufacturers put the best steel in their cars?

Ask the Accessory Man

What manufacturers put the best accessories in their cars?

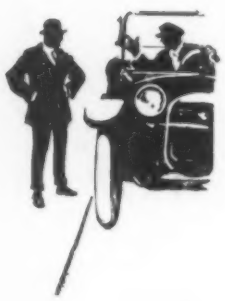
Ask the Banker

What automobile firms have made good financially and are able to back up their cars?



Ask the Automobile Dealer

What are the three best automobiles in the class from $1400 to $2400?



Ask the Owner

How he is satisfied with his Chalmers Six—ask him particularly about its *monthly cost* for up-keep?

And the Answers

You will find more than substantiated by going to the nearest Chalmers dealer and there examining the Chalmers. In this way you will be *buying* a car, and not being *sold* one.

Chalmers Models

New Six-40 at $1400 ***Light Six-48 at $1650***
Master Six-54 at $2400

CHALMERS MOTOR CO. Detroit, Mich. U.S.A.

Quality First

Chalmers Motor Company, Detroit

Let Your Next Car Be a Chalmers

CHICAGO ILL.
"KEWANEE SMOKELESS BOILERS INSTALLED."

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"KEWANEE SMOKELESS BOILERS INSTALLED"

LOUISVILLE, KY.
"KEWANEE SMOKELESS BOILERS INSTALLED"

CANTON
OHIO
"KEWANEE SMOKELESS BOILERS INSTALLED."

KANSAS CITY MO.
"KEWANEE SMOKELESS BOILERS INSTALLED."

NEW YORK
CITY
"KEWANEE SMOKELESS BOILERS INSTALLED."

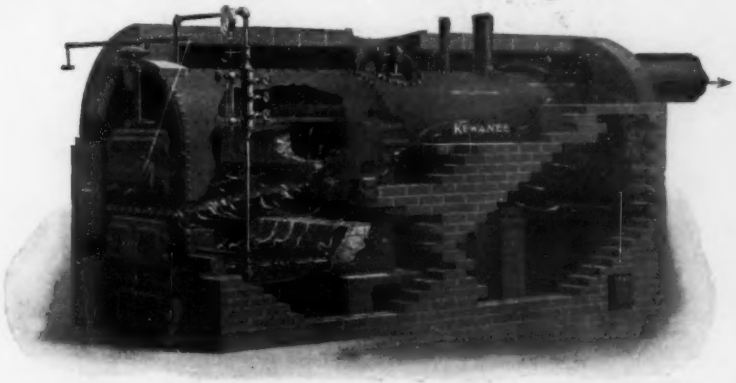
KEWANEE

Smokeless Boilers Cut Coal Costs

¶ Kewanee Smokeless Boilers are burning the cheapest of soft coal smokelessly and are saving thousands of coal dollars, every year, in many of the best buildings in all parts of this country and Canada.

¶ They save fuel money in two ways; First, by permitting the use of low priced soft coal, even in cities where a rigid smoke ordinance is enforced: Second, because they get from fuel, and use for heat making purposes, a bigger percentage of the heat in the coal than can be obtained by the ordinary boiler.

¶ Our booklet "Cutting Coal Costs" is of interest to any large user of coal. It will go on request.



In a Kewanee Smokeless Boiler (brickset or portable type) the fire is built on the upper, water tube grates, the fire on the lower grate being maintained by the hot coals dropping onto it from above. The draft is down which draws all the heat giving gases down through the hot fire on the upper grate then down and over the fire on the lower grates. This completely burns all the heat giving gases before they can be condensed into smoke.

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KEWANEE, ILLINOIS

Steam Heating Boilers, Radiators, Garbage Burners and Tanks

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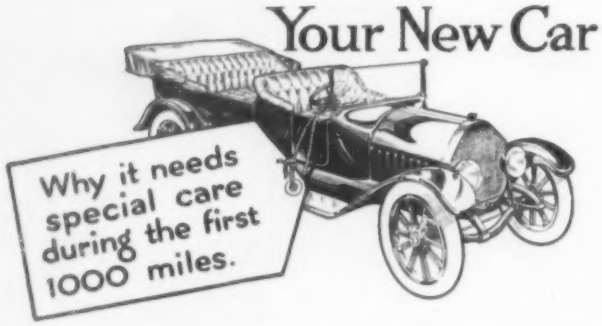
EL PASO, TEX.
"KEWANEE SMOKELESS BOILERS INSTALLED"

CHAMPAIGN, ILL.
"KEWANEE SMOKELESS BOILERS INSTALLED"

MUNSEY, IND.
"KEWANEE SMOKELESS BOILERS INSTALLED."

Your New Car



YOUR automobile in one respect is like any other piece of machinery. It "settles down" only after use. If well maintained it will run better the 2,000th mile than the first.

Motor trouble and undue noises are too often caused by early neglect. The metal worn off by friction is gone forever.

And your lubricating oil is your only protection against this friction wear.

At all times and especially during the important "settling down" period, when the moving parts have not fully adjusted themselves to each other, oil of the highest lubricating efficiency is of the utmost importance.

Each piston makes several thousand strokes per mile.

The effect of the wrong oil will not be noticed during the first piston stroke, or the second. But when the piston strokes run up into the millions—and that does not take long—friction begins to get its due. You do not have to *look* for the wear then. You *hear* it.

Realizing the need of scientific help, careful motorists are turning for correct lubrication to the Vacuum Oil Company's Chart of Automobile Recommendations.

The oil specified insures high lubricating efficiency through its correct *body* and superior *quality* and throughout the life of the car insures a low operating cost per mile. The continued efficiency of the motor is full evidence of the way in which the oil protects each moving part. The carbon deposit is rarely troublesome. And the "wear" of the oil itself is unusual.

The Chart on the right represents our professional advice. If your car is not listed, send for a complete copy of this standard guide to correct lubrication.

GARGOYLE

Mobiloils

A grade for each type of motor

In buying Gargoyle Mobiloils from your dealer, it is safest to purchase in original packages. Look for the red Gargoyle on the container. For information, kindly address any inquiry to our nearest office.

Correct Lubrication

Explanation: In the schedule, the letter opposite the car indicates the grade of Gargoyle Mobiloils that should be used. For example, "A" means Gargoyle Mobiloil "A." "Arc" means Gargoyle Mobiloil "Arctic." For all electric vehicles use Gargoyle Mobiloil "A" for motor and enclosed chains. For open chains and differential use Gargoyle Mobiloil "C." The recommendations cover all models of both pleasure and commercial vehicles unless otherwise noted.

MODEL OF	1911		1912		1913		1914		1915	
CARS	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Abbott Detroit	A	Arc	A	Arc	A	Arc	Arc	Arc		
Alco	Arc	Arc	Arc	Arc	Arc	Arc				
American	A	Arc	A	Arc	A	Arc	A	Arc		
Apperson	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Auburn (4 cyl)	A	A	A	A	A	A	A	A	A	Arc
" (6 cyl)							Arc	Arc	Arc	Arc
Autocar (2 cyl)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (4 cyl)	A	Arc	A	Arc						
Avery	A	E	A	A	A	A	A	A	A	A
" (Model C) 2 Ton							Arc	Arc	Arc	Arc
Buick	A	Arc	A	Arc	A	Arc	A	Arc	Arc	Arc
Cadillac	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
" (8 cyl)									Arc	Arc
Carter car	A	E	A	E	A	E	Arc	Arc	Arc	Arc
" Com'l	A	Arc	A	Arc	A	Arc				
Case	A	A	A	Arc	A	Arc	A	Arc	A	Arc
Chalmers	A	Arc	Arc	Arc	Arc	Arc	A	A	Arc	Arc
Chandler							Arc	Arc	Arc	Arc
Chain (air)	B	B	B	B	B	B	B	B	B	B
" (water)							Arc	Arc	Arc	Arc
Chesterfield six									A	Arc
Chevrolet					A	A	A	Arc	Arc	Arc
Cole	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Cunningham	A	A	A	A	A	A	Arc	Arc	Arc	Arc
Delaunay-Belleville	B	A	B	A	B	A	B	A		
Detroiter			A	Arc	A	Arc	A	A	A	Arc
" (8 cyl)									Arc	Arc
Dodge									E	E
E. M. F.	Arc	Arc	Arc	Arc						
Empire	A	Arc	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Fiat	B	A	A	A	B	A	B	A	B	A
Flanders	E	E	Arc	Arc						
" (6 cyl.)					Arc	Arc				
Ford	E	E	E	E	E	E	E	E	E	E
Franklin	A	Arc	A	Arc	A	Arc	A	A	A	A
" Com'l	B	A	A	Arc	A	Arc				
Garford	A	E	Arc	Arc	Arc	Arc				
" Com'l	A	Arc	Arc	Arc	Arc	Arc	A	A		
Grant							Arc	Arc	Arc	Arc
Havers	A	Arc	A	Arc	A	Arc	A	A		
" (Model 6-60)							Arc	Arc		
Haynes	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Hudson	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Hupmobile					A	Arc	A	Arc	A	Arc
" (Model 20)	Arc	Arc	Arc	Arc	Arc	Arc				
I. H. C. (air)					B	A	B	A	B	A
" (water)					A	A	A	A	A	A
International	B	B	B	A						
Interstate	A	Arc	A	Arc	A	Arc				
Jackson	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Jeffery							A	A	A	Arc
" Com'l			Arc	Arc	Arc	Arc	Arc	Arc	A	Arc
Kelly Springfield	Arc	Arc	Arc	Arc	Arc	Arc	A	A	A	A
King	A	E	A	E	A	E	A	A	A	Arc
" (8 cyl)									Arc	Arc
" Com'l							Arc	Arc	Arc	Arc
Kissel Kar	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" Com'l	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc	A	Arc
" " (Model 48)							A	A	A	A
Kline Kar	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc	A	Arc
Knox	B	A	B	A	B	A	B	A	B	A
Krit	A	A	A	A	A	A	A	A	A	Arc
Leppard Stewart			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Locomobile	Arc	Arc	Arc	Arc	Arc	Arc	E	E	E	E
Lozier	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc		
Lyons Knight							A	B	A	
Mack	A	E	E	E	E	E	A	E	A	E
" (Model B)					A	A	A	A	A	A
Marion	A	E	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Marmon	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Maxwell	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Mercer	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (22-70 Series)									Arc	Arc
Metz	B	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Mitchell	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Moline	A	Arc	A	Arc	A	Arc				
" Knight							A	A	A	A
Moon (4 cyl.)	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc	Arc	Arc
" (6 cyl.)							Arc	Arc	Arc	Arc
National	A	A	A	A	A	A	A	A	A	Arc
Oakland	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Oldsmobile	A	Arc	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Overland	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Packard	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc	A	Arc
Paige	A	Arc	A	E	A	E	A	A	A	Arc
" (6 cyl)									Arc	Arc
Pathfinder					A	Arc	Arc	Arc	Arc	Arc
Peerless	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Pierce Arrow	A	Arc	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" Com'l	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Pope Hartford	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Premier	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Rambler	A	Arc	Arc	Arc	Arc	Arc				
Regal	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Renault	A	Arc	A	Arc	A	Arc	A	Arc		
Reo	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
S. G. V.	B	Arc	B	Arc	B	Arc	A	Arc	A	Arc
Saurer	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Saxon							E	E	E	E
Selden	A	E	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Simplex	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Speedwell	A	Arc	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" Mead					A	Arc	B	A	B	A
Stearns	A	Arc	A	Arc						
" Knight			A	A	A	A	B	A	B	A
" (Light 4)									A	Arc
Stevens Duryea	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Studebaker-Dayton	A	A	A	A	A					
" Knight			A	A	A	A				
Studebaker	A	Arc	Arc	Arc	A	Arc	A	Arc	Arc	Arc
Stutz			Arc	Arc	Arc	Arc	A	A	A	A
Velie (4 cyl.)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (6 cyl.)							Arc	Arc	Arc	Arc
Walter	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	A	A
White	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Willys Knight							A	B	A	
" Utility							A	Arc	Arc	Arc
Winton	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc

The four grades of Gargoyle Mobiloils for motor lubrication, purified to remove free carbon, are:

Gargoyle Mobiloil "A"
Gargoyle Mobiloil "B"
Gargoyle Mobiloil "E"
Gargoyle Mobiloil "Arctic"

VACUUM OIL COMPANY, Rochester, N. Y., U. S. A.

Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world.

DOMESTIC BRANCHES: Detroit, Boston, New York, Chicago, Philadelphia, Indianapolis, Minneapolis, Pittsburgh

Speeds Up Spring Building!

Concrete was once handicapped by slow construction methods. *Was*, not *is*—for Self-Sentering, the new expanded steel reinforcement, has eliminated form-work. The order, "Go ahead—pour the concrete," now comes weeks earlier on the job than it did with old methods. Builders pour concrete now when they used to be rushing half-built forms to completion.

And, along with the time saved by using Self-Sentering and no forms, there's labor saved and lumber saved.

Patented March 3, 1914—Other patents now pending

widened the field of concrete construction. You can now afford to put, into even minor buildings, materials that will last for ages, that can not burn, that will not deteriorate.

Learn the Self-Sentering method of construction—light, economical, fireproof, imperishable. Tell us your special needs and let us send our new edition of the

Fireproofing Handbook

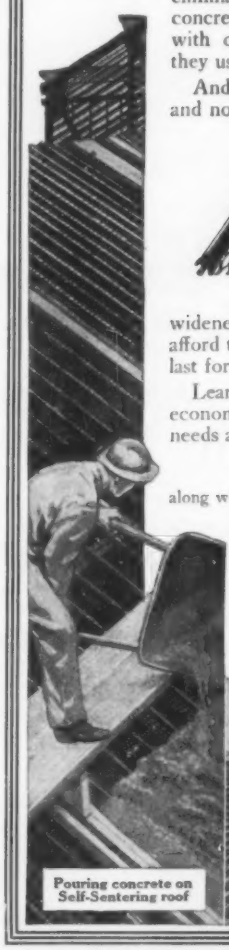
along with valuable facts, proofs, plans, advice. When writing, state your architect's or builder's name and we will gladly cooperate with him in his efforts to give you indestructible buildings at the old-time cost of short-lived construction.

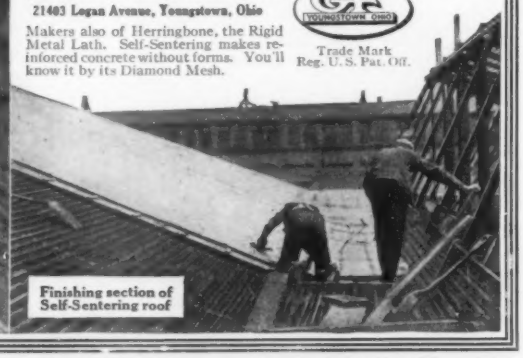
THE GENERAL FIREPROOFING CO.
21403 Logan Avenue, Youngstown, Ohio

Makers also of Herringbone, the Rigid Metal Lath. Self-Sentering makes reinforced concrete without forms. You'll know it by its Diamond Mesh.

GF YOUNGSTOWN OHIO

Trade Mark Reg. U. S. Pat. Off.


Pouring concrete on Self-Sentering roof


Finishing section of Self-Sentering roof

Performance-Not Price

The maker who equipped your car or truck with the Buda Motor did not select his motor "on price." He was jealous of his reputation and his product; he believed that your satisfaction was part of the bargain when you handed him your check. So, regardless of price, he made comparisons and careful tests and finished by selecting the Buda Motor, built by a great organization which *for 35 years* has backed every last screw and bolt of its product with its name and all its vast resources. Every Buda Motor is not only guaranteed—it is *much more than guaranteed* by the fact that a part of its duty is to live up to the name it bears.

"If the MOTOR is not right, the car is wrong"

THE BUDA COMPANY, HARVEY CHICAGO SUBURB ILLINOIS

SEVENTY-FIRST YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXII.] NUMBER 14. NEW YORK, APRIL 3, 1915 [15 CENTS A COPY $3.00 A YEAR

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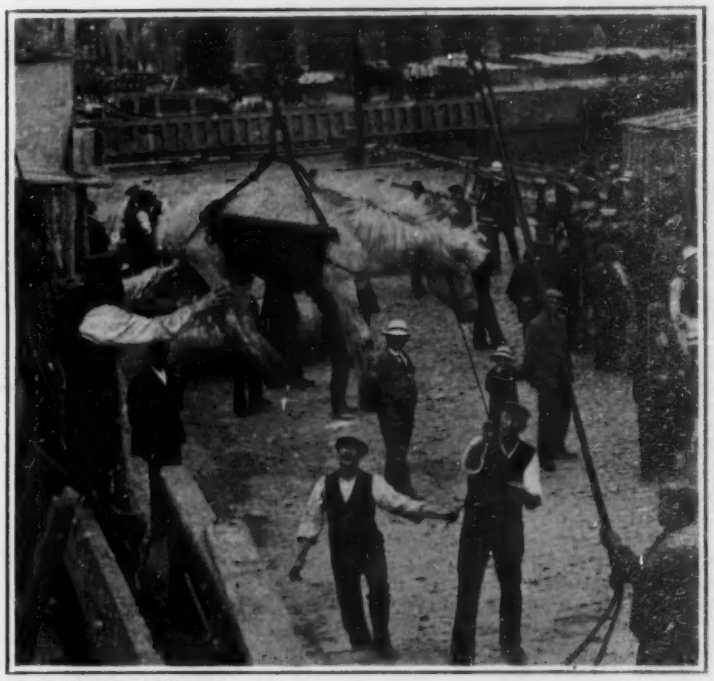
A pile of German 15-centimeter shells and the wicker casings used in transporting them.

Photograph by Branger

A French kite balloon ready to ascend in order to make observations of the effect of artillery fire on the enemy.

Photograph by Underwood & Underwood

A British tommy cooking his dinner on a brazier in the trenches.



Photograph by Underwood & Underwood

Army horses are scarce. Little Icelandic ponies are imported in great numbers.

Copyright by International News Service

The broken-backed "L-3" of Germany's aerial fleet on Sanoe Island

This airship, a Zeppelin, while on a reconnoitering voyage, descended during a storm owing to a defect of its motor. The airship was lost, but the crew were saved. Immediately after the catastrophe the airship burst into flames. The captain declares that he set the Zeppelin on fire purposely "in order to prevent her from being blown further ashore and imperil its lives and the adjacent buildings." The crew had time to land their ammunition and bombs.

THE NEWEST PICTURES OF THE GREAT WAR

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, APRIL 3, 1915

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Munn & Co., Inc., 233 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp* the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Battle-cruiser

CONGRESS has adjourned without making provision for the addition of any battle-cruisers to our Navy, an omission for which, in our opinion, the country may have to pay very dearly if hostilities should ever overtake us. The motive which has led the department to recommend the construction of battleships to the exclusion of battle-cruisers is the realization of the fact that the winning or losing of a campaign, other things being equal, depends upon the relative strength of the first fighting line of dreadnoughts of the two contending navies. It is claimed that whatever temporary advantage may be gained by battle-cruisers in scouting, harassing the enemy's shipping or bombarding seacoast cities, the issues of a war will be determined when battleship ranges up against battleship to fight it out to the death. The point of view is assumed that the battle-cruiser, because of its lighter armor, will not be able to lie in the front line—an assumption which, in view of the actions which have been already fought between battle-cruisers, seems to us to be rather doubtful. The steep angle of fall of the shell at the great ranges which promise to govern future fighting, has upset the theories of armor protection; for the few facts which have filtered through indicate that a large percentage of the hits are upon the deck and not upon the side armor, and a plunging fire of this character seems to wipe out to a not inconsiderable extent the advantage conferred by the heavier side armor carried by battleships. But even if it be granted that the battle-cruiser will not lie in the first line of battle, is the subordinate work for which her combination of high speed and heavy gun power render her so effective, of such minor importance that we can afford to dispense with this type altogether? Certainly the developments of the present war do not support this point of view.

Had Great Britain possessed no battle-cruisers, the armored cruisers of Von Spee might be ranging the high seas to-day, sinking merchant shipping and overtaking and crushing by superior gunfire the more lightly armed cruisers of the "Good Hope" and "Monmouth" type. The battle-cruisers of the German home fleet would be free to make a dash now and then across the North Sea, raiding coast towns and sinking any British armored and protected cruisers which they might encounter. Because of their great gun power and the possession of the speed gage, they would have the complete mastery of any vessels of this type. Possessing seven or eight knots superiority of speed over the British dreadnought fleet, they would be free to accept or avoid engagement, as the circumstances of the hour and place might dictate. Furthermore, there would always be the possibility of their breaking through into the open by way of the North of Scotland, and carrying out a raid along the main lines of steamship travel, which might easily result in the loss of some of the finest ocean liners of the allied powers.

Should we ever find ourselves at war with Germany (which God forbid), the lack of battle-cruisers would prove to be a terrible handicap. For scouting work ahead of our main fleet we would have but three 23½-knot cruisers, and we might use a few of our 22-knot armored cruisers; but of what avail would they be to break through German scouting lines which contain half a dozen 28 to 30-knot battle-cruisers? To send our slow and lightly armored craft against these formidable ships would be not only to fail utterly to ascertain the strength and composition of the enemy, but it would be to offer them for certain destruction. Again, when the main fleet was lined up for battle it would be possible for these fast ships to forge ahead and steam across our line, raking its leading ships with a powerful concentration of heavy gunfire.

The Spanish-American war has not passed so far into history but that many of us will remember the political pressure which was brought upon Congress to send armored ships for the protection of the various important seacoast cities. In the event of such a conflict to-day, we could not spare a single battleship for this purpose; and anything we possess outside of our battleships is worse than useless as a protection against the long range of 11- and 12-inch guns of the German battle-cruisers.

Our submarines? No, we could not rely upon them as a protection; for it has been proved over and over again in this war that ships of 28 to 30 knots have very little to fear from the submarine, so long as they make use of their great speed. Such is the ranging power of their guns that these vessels could steam to and fro, well outside of the range of our coast fortifications, and, assisted by observation of their accompanying destroyers or of seaplanes carried by the fleet, they could silence our seacoast guns with the same deliberation with which the "Queen Elizabeth" has reduced some of the fortifications of the Dardanelles.

One of the most important demonstrations of the present war has been the great value of the combination of heavy guns and high speed. If the next Congress will but listen to its technical advisers, it will authorize the construction, in addition to whatever battleships are required, of at least two ships of the battle-cruiser type.

The Small Farm Tractor

BOTH mechanical and economic obstacles have confronted the designer and builder of the ideal small agricultural tractor. The wider range of usefulness demanded made it impossible simply to reproduce the successful large tractors in miniature. Extra speeds, more efficient traction devices, greater flexibility and easier manipulation had to be provided for. The impossibility of reducing the width of the tractor in proportion to its power and the number of plows pulled, created a strong side draft in plowing which utterly doomed many a tractor that did admirable work at hauling, for instance, since plowing is the all-important job for the farm tractor.

More frequent use on the road demanded more care in protecting highway surfaces from damage, while still keeping a high tractive efficiency under all conditions. Reduction in size carried with it a natural decrease in accessibility unless persistently guarded against. Reduction in power was apt to increase the weight per brake horse-power and cut down the drawbar delivery unless lighter parts of better material were used.

Manufacturing cost was inevitably increased in proportion to power—increased until the small tractor could claim little or no advantage over animals in first cost. Increases in cost of labor and materials nearly offset the rise in price of horses and feedstuffs, effectually maintaining the *status quo*. Service cost more in proportion. Selling cost the maker less, and he usually reaped the advantage of a larger percentage of cash than on big outfits. But against any possible price inducements rose the increase to the farmer in proportionate labor cost of operating. Moreover a much higher ratio of animal power had to be kept for odd jobs, e. g., a farmer with twenty-five horses might easily get along with a tractor and four instead, while he with but six horses might still have to keep two.

The odds seemed all against a tractor of less than 25 to 30 brake horse-power, giving 12 to 15 horse-power at the drawbar and handling four to six ordinary plows. But horses and their feed rose faster in price than tractors and fuel. (What may be the effect of the war and its enormous drain upon America's horse supply is of course problematical. Probably it will hasten the adoption of tractors hitherto accepted with some hesitation.) The introduction of self-lift plows, which eliminated the plow tender, cut out about a third of the labor cost—a development greatly favoring the small tractor, and one at which inventors of self-contained motor plows had long been aiming.

As a result of these factors, and in response to an incessant demand, we now have our choice of a considerable variety of tractors weighing less than 8,000 pounds (the weight of five or six horses), each designed to do the work of four to ten horses and priced all the way from $500 to $1,600 free on board factory. Some are unquestionably ready for the market. Others are far from it and need be considered only as they represent principles that may "arrive" later. Out of the whole lot there is the strong promise of one or more solutions of this most difficult mechanical problem. For difficult it is.

An automobile has merely to propel itself and carry a load—usually on fairly level, fairly firm surfaces. Light cars fulfilling average requirements have been standardized in ten years to the point of duplication by the hundred thousands. The light tractor, however, must go over almost any kind or condition of soil, up maximum grades, through ditches and over the rough places, pulling a heavy dead load behind it. Yet it must damage no road and pack no cultivated soil.

A car builder whose name is almost synonymous with standardization has put in the greater or lesser part of five years experimenting with small tractors—and still sticks to automobiles. The designer of one of the largest gas engine power plants in the world tackled the problem and failed. One of the leading educators in America along stationary gas engine lines—a consulting engineer and author of a much-used textbook—essayed the design of a tractor for a large manufacturer, but his work never saw the light of day.

Lest Jack Be a Dull Boy

AN enlightened industrial establishment which provides its employees with ball grounds and tennis courts, reading rooms and card rooms, is furthering its own interests, not only by making its employees better contented, but also by increasing their efficiency. The downright utility of relaxation and rational amusement demands more general recognition than it has heretofore received in America. From time to time we hear of narrow-minded public officials in Washington who endeavor to discourage the rank and file of Government employees from taking the thirty days' annual vacation allowed them by law, by giving high "efficiency ratings" to those who refrain from doing so; whereas a more logical plan would be to penalize employees who do *not* take vacations.

The English, as a race, are decidedly more inclined to rate amusements at their proper worth in the scheme of the human normal existence than are their cisatlantic cousins. An illustration of this fact is found in a comparison of "Who's Who" with "Who's Who in America." At the end of each biography in the former work the favorite "recreations" of the subject are generally stated, while the publishers of the corresponding American work have not seen fit to include this feature.

A compilation of the "recreations" enumerated in "Who's Who" would make interesting reading, and we commend this undertaking to some magazine writer who has run short of topics. They range over a wide field. Many English notables prefer such strenuous forms of amusement as mountaineering, big game shooting, and exploring. Tennis, golf, cricket, and the like naturally recur at frequent intervals in these enumerations. Madame Adi Crossley, the singer, prefers "riding—the favorite recreation of all true Australians." One Irish gentleman (J. P. Crowly) amuses himself with travel, "and anything else that may turn up." An eminent solicitor (Sir Frank Crisp) is evidently a believer in *utile dulci*, for his pleasures are "horticulture, microscopy, and—company law." Prof. James Geikie, who died the other day, admitted that his chief diversion was "loafing in pleasant places with a congenial friend."

Frederick Winslow Taylor

THE late Frederick Winslow Taylor, pioneer among efficiency engineers, injected a new element into industry. He showed that the proper conduct of a business enterprise is a scientific problem to be solved by scientific methods. In that sense he raised manufacturing to the dignity of an applied science. In another sense he supplied political economy with a new principle; for his study of the problem of production has been a distinct aid to students who never thought it part of the economist's business to concern himself with factory methods. Before Frederick W. Taylor made efficiency engineering what it has become, the directors of an industrial enterprise thought that cheap raw material, good automatic machinery, and a good cost accounting system represented the alpha and omega of manufacturing. But he proved that organization, in the strict military sense of the word, was lacking in most factories; that ideals were wanting; that arrangement of machines was as important as the machines themselves; that the men and executives had to be considered from the standpoint of useful pieces of machinery as well as from the standpoint of labor cost; that a workingman is to be treated with consideration and regarded as an investment rather than as a source of expenditure. Labor unions in particular have misunderstood the work of Taylor. If they only realized it, he and his whole school have done more to improve the conditions of labor, have done more to make the laborer worthy of his hire and the hire worthy of the laborer than all the unions combined. His name will go down not only as a great engineer, not only as a great industrial scientist, but as a great humanitarian.

Electricity

Connecting Nitrogen Lamps in Series.—A writer in the *Zeitschrift für Beleuchtung* suggests the introduction of the series system of connecting nitrogen filled tungsten lamps. A shunt must be provided for each lamp to prevent extinction of the entire series when one lamp fails, and it is proposed that a carborundum resister in solid or powdered form be used, for this, when cold, allows but little current to pass, but when the lamp is extinguished more current passes through the carborundum, heating it, thereby making it a better conductor.

Electric Confectionery Shops are to found in St. Paul and Minneapolis. The owner of these shops is a great believer in electricity and he has equipped his tables with candle lamps and desk telephone sets. A customer seats himself at the table, looks at a handy table directory or menu, finds the number of the particular dainty he desires and gives his order by telephone. A minute later the order is placed on his table by a waiter. The system saves a great deal of time because the waiters do not have to make a trip to the table to find out what the customer wants, nor do they have to wait while the customer is deliberating over his choice.

A Troubleman's Headlamp.—The troublemen of the Northern Power Company of Duluth are using a convenient type of acetylene lamp arranged, like a miner's lamp, to be worn on the head. This lamp has proved invaluable on locating line troubles at night. Only the lamp and reflector are carried on the head, the generator being carried either on a belt or in the pocket. This is connected to the burner by a non-collapsible rubber tube. The lamp is provided with a single or double lens to concentrate the light, and the reflector which is of aluminium or silver may be adjusted to throw the light up or down.

Small Tungsten Lamps with Concentrated Filaments.—The distinctive feature of the concentrated filament tungsten lamps of high wattages have proved so popular that similar lamps in the 25, 40 and 60 watt sizes have now been developed. This concentrated filament construction gives greater vertical distribution of light than the regular lamps of corresponding wattages. The new lamps will, therefore, be employed where natural distribution of light downward is required. They can be used in existing sockets and fixtures. These lamps will be made in the same sized bulbs as the corresponding regular tungsten lamps, will have the same spherical watts per candle-power efficiency and will have a rated average life of 600 hours.

Illumination of the New Subway Cars.—After a series of experiments the New York Municipal Railway Corporation has decided upon a new system of illumination for its subway cars. The head lining and walls down to the window sills will be enameled white, so as to provide excellent reflecting surfaces. Bowl-frosted tungsten lights will be used, arranged in a single row along the center line of the ceiling. The cars are 9 feet wide inside and 65 feet long, and there will be fifteen of these 56-watt tungsten lamps supported in 6-inch opal reflectors. The effect of this illumination is to give a soft and uniformly distributed light. The eyes of the passengers will not be exposed to the glare of the glowing filaments. The power consumption of this illumination will amount to under 1.5 watts per square foot.

The Efficacy of Lightning Rods on farm buildings has recently been the subject of an investigation conducted by Prof. J. Warren Smith, of the Weather Bureau, who reported the results at the last annual meeting of the National Association of Mutual Fire Insurance Companies. Prof. Smith addressed a circular letter to mutual insurance companies throughout the country, especially those in the rural districts, soliciting information as to the damage done to insured farm buildings by lightning in comparison with losses due to other causes, the distribution of such damage between rodded and unrodded buildings, etc. The answers give striking evidence of the value of rods. In 1912 and 1913 about 200 mutual companies doing a business of fully $300,000,000 had 1,845 buildings struck by lightning. Of this number only 67 were equipped with lightning rods. So far as could be learned about 31 per cent of the buildings insured by these companies were rodded; hence, if the rods had furnished no protection the number of rodded buildings struck should have been 572, instead of 67. Thus the efficiency of the rods in actually preventing lightning strokes appears to have been about 90 per cent. It may be fairly assumed that a large part of the damage done to the rodded buildings occurred in cases where the rods were improperly installed or in poor condition. Five companies, with over 18,000 buildings insured, of which more than 50 per cent were rodded, reported that they had never had a building burned or even materially damaged by lightning that was equipped with a lightning rod; their records covered periods ranging from 13 to 25 years. Another important fact brought out by Prof. Smith's figures is that when a rodded building is struck by lightning and damaged but not burned down, the average damage is much less than in an unrodded building, viz., $10 in the former case and $2200 in the latter.

Science

The Radium Institute, of London, in its last annual report states that 746 cases were treated during the past year, of which 19 are reported cured, 50 apparently cured, and 328 improved, while in 136 no results had been noted up to the date of writing. Varying results are recorded in cases of cancer, tumors, and other diseases. Certain cases of skin discoloration and warts have been treated with marked success, while the most intractable cases of spring catarrh have been cured.

Drug Addiction in the United States.—According to a recent estimate of the U. S. Public Health Service the number of persons in this country who are victims of the drug habit is about 70,000, and the number of doses of narcotic drugs consumed by them annually is about 850,000,000. This estimate is based on figures collected in the State of Tennessee, where under a recently enacted anti-narcotic law, 1,403 permits were issued in six months to persons petitioning for the privilege of using narcotic drugs, and the consumption of such drugs amounted to 8,498,200 average doses.

The Northeast Passage.—Commander Vilkitskii, the discoverer of Nicholas II. Land, set out last summer from Vladivostock on his third attempt to make the Northeast Passage from the Pacific to the Atlantic. According to news recently received, he was wintered in Taimyr Bay, to the west of Cape Chelyuskin. Here he has been in wireless communication with Captain Sverdrup, who sailed from European Russia last summer in search of the missing Brussilov and Russanov expeditions, and has also wintered on the coast of the Taimyr peninsula. A note in *Nature* states that Vilkitskii proposed to send part of his crew to Sverdrup's ship, in order to economize his supplies, with a view to the possibility of not getting through the ice next summer.

Rainfall Records in Metric Units.—Since May 1st, 1914, the British Meteorological Office has published rainfall values in millimeters in place of inches, in its Daily Weather Report. Beginning January 1st, 1915, the millimeter is also used in the Weekly and Monthly Weather Reports. The director of the Meteorological Office, in commenting on this change, points out that metric measurements are now used almost universally in scientific work, and that the maintenance of a system of non-metric units for practical life causes a dissociation between science and practice which is found to be injurious to both. Moreover, the millimeter is a more convenient unit for recording rainfall than the hundredth of an inch.

Some Interesting Fishery Statistics relating to the seas west of Norway were presented in a recent lecture by Dr. John Hjort, the well-known Norwegian fishery expert. The work of tagging fish, setting them free, and recording the time and place of subsequent capture has now been in progress for a number of years and has given most valuable information as to the migration of fish and as to the ratio of the catch of any given year to the total number of fish available. This ratio is about 1 to 10 in the case of the common food fishes. Attention has also been paid to the age and growth of fishes, as indicated by annual rings on their scales, and it has been learned, among other things, that fish make faster growth in some years than in others, regardless of their individual ages.

Sea Moss.—This term is popularly applied to any of the *Polyzoa*, which are compound marine animals, several of which share a common horny skeleton, or polyzoary, which is plant-like in form. According to the Bureau of Fisheries, several hundred thousand pounds of these skeletons have been imported annually from Europe, chiefly from France and Germany, for decorative and millinery purposes, and the supply has now been practically cut off by the war. It therefore seems opportune to develop a domestic industry, as sea mosses, probably equal in quality to those heretofore imported, are said to be abundant on our coasts, especially in New England. Those with large bushy fronds are the most valuable.

The Colorado Geographic Board.—The Colorado Geographic Society, recently founded in Denver, has organized a small committee known as the Colorado Geographic Board, the duties of which are to supervise and clarify the geographical names of Colorado, to collect and preserve the historical associations of towns, streams, mountains, highways, passes, and other geographical features of the State, and to eliminate duplicate and otherwise undesirable geographical names. The board has announced that it will "attempt in every way to secure a nomenclature that will be appropriate and that will reflect the romance and adventure of historical and pioneer days in Colorado." It is not the intention to make radical and sweeping changes in names, but to settle questions as they arise and to bring about needed reforms gradually. This undertaking appears to be wholly admirable and worthy of imitation in other states, always provided it is conducted by intelligent and scholarly persons, as appears to be the case in Colorado.

Automobile

Looking Underneath the Motor Car.—Many a prospective purchaser of a motor car would like to take a peep below the chassis—when he views the car in all its glory in the salesroom. A Chicago dealer has solved the problem by hanging one of the show cars 7 feet above the ground, supported by strong steel cables. The height enables both salesman and "prospect" to walk beneath the car and examine it from below.

An Automobile Lock.—Thomas J. Kehoe of Toledo, Ohio, has secured patent No. 1,126,781 for an automobile lock which has a swinging arm pivoted at one end to the ordinary slotted guide for the controlling lever of the engine. This arm has at its swinging end a notch which can be swung to receive the controlling lever when the latter is in neutral position and a lock secures the swinging arm in this position.

Elastic Safety Bumper for Motor Cars.—A novel type of automobile bumper has just been brought out by a New York company. It consists of a hollow rubber tube, supported on a steel fender, beyond which it projects about two inches. Should any person or object be in danger of collision with a motor car so equipped, a large part of the shock is absorbed by the rubber tube, while the rest loses itself in the springs which support the steel fender itself.

The Auto Tire of the Future.—Many improvements have so perfected the auto tire as even to render racing comparatively safe. It is believed, however, that some radical departures will mark the greatest development in this line. Just where this is to be is difficult to say. Inventors have been improving the inner tubes, the tread surfaces of the shoes, the fabrics and the means for holding the shoes to the rims. Possibly the tire to revolutionize the industry will combine the air cushion and spring features in such a way as to overcome the defects and shortcomings of both forms.

Triplex Glass Now Greatly Used.—Triplex glass, which created a good deal of comment when it was first announced a year ago, is now appearing on the market in many forms, especially in Great Britain, where it has caught the fancy of motorists. The glass is made into limousine windows, windshields, goggles, etc. It consists, as readers of the SCIENTIFIC AMERICAN will remember, of two sheets of thin glass with a thin sheet of xylonite between them, the whole three sheets being combined by glucose and hydraulic pressure into a homogeneous mass. It cannot be shattered into splinters by any agency. It will crack and break under hammer blows, but no splinters will fly, endangering people.

Vulcanizes Tires by Chemical Means.—Although strictly speaking every vulcanization of an automobile tire is a "chemical reaction," the system invented by W. A. Miles deserves this appellation more than any other, because of the application of heat by a new method. Instead of using steam or electricity, Miles takes a small block of a deflagrating substance, as for instance a mixture of charcoal and saltpeter, or chlorate of potassium and wood dust. Putting the mixture, in form of a pill or block, on a metal plate in contact with the tire, it is ignited and the heat developed used to vulcanize the tire repair patch. The size of the "pill" can be regulated to give just as much heat as is needed for the vulcanization.

Synthetic Rubber from Crude Oil.—So many disappointments have been recorded following announcements of new methods of making rubber synthetically, that rubber importers and users are now exceedingly wary in accepting statements to that effect. But news has just come from Baku, Russia, which seems valuable enough to deserve a thorough test in the California oil fields. It seems that there are certain fractions in the Baku crude oil (which are also prevalent in the California oil) boiling between 98 and 106 degrees, which yield nearly 20 per cent of their weight in adipic acid. This adipic acid can be converted into butadiene through the action of its own amide, in a commercially practicable process. Butadiene, again, can be converted into caoutchouc by means of another simple and inexpensive process. Experiments are already under way to discover the practical value of this discovery.

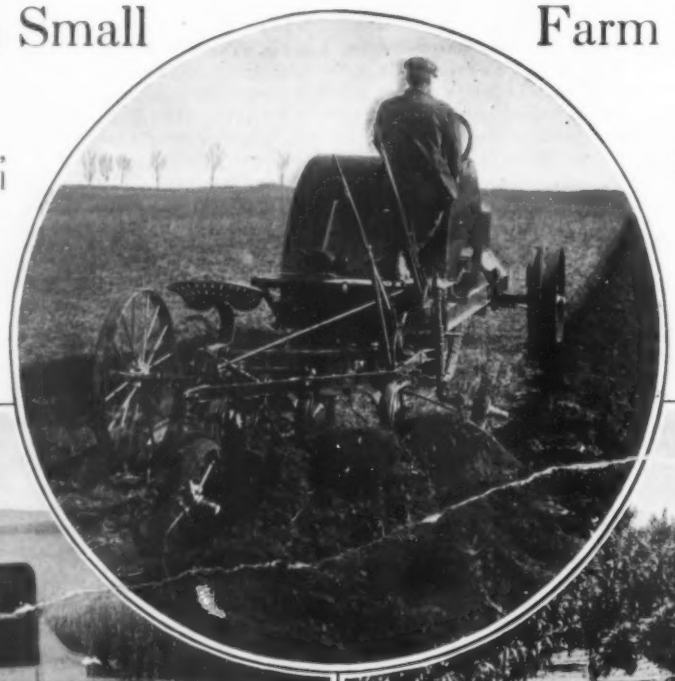
An Anglo-French Car.—Among the things that were not talked about much abroad formerly but which the friendlier feeling created by the military alliance is bringing to public notice is the close relations that have been sustained in the automobile manufacture between England and France. In this connection note is being made of a popular car that was designed by an Englishman, and is built in France by an Anglo-French company. A new model of this car, just brought out, has four cylinders 85 millimeter bore by 130 millimeter stroke and rated at 16 horse-power, and is said to have given excellent performances over hilly and difficult roads. The cooling water is circulated by a pump, and there is a pump operated automatic lubricating system that is attracting attention on account of the absence of all small by-pass holes that so frequently choke and make trouble.

Progress in Small Farm Tractors

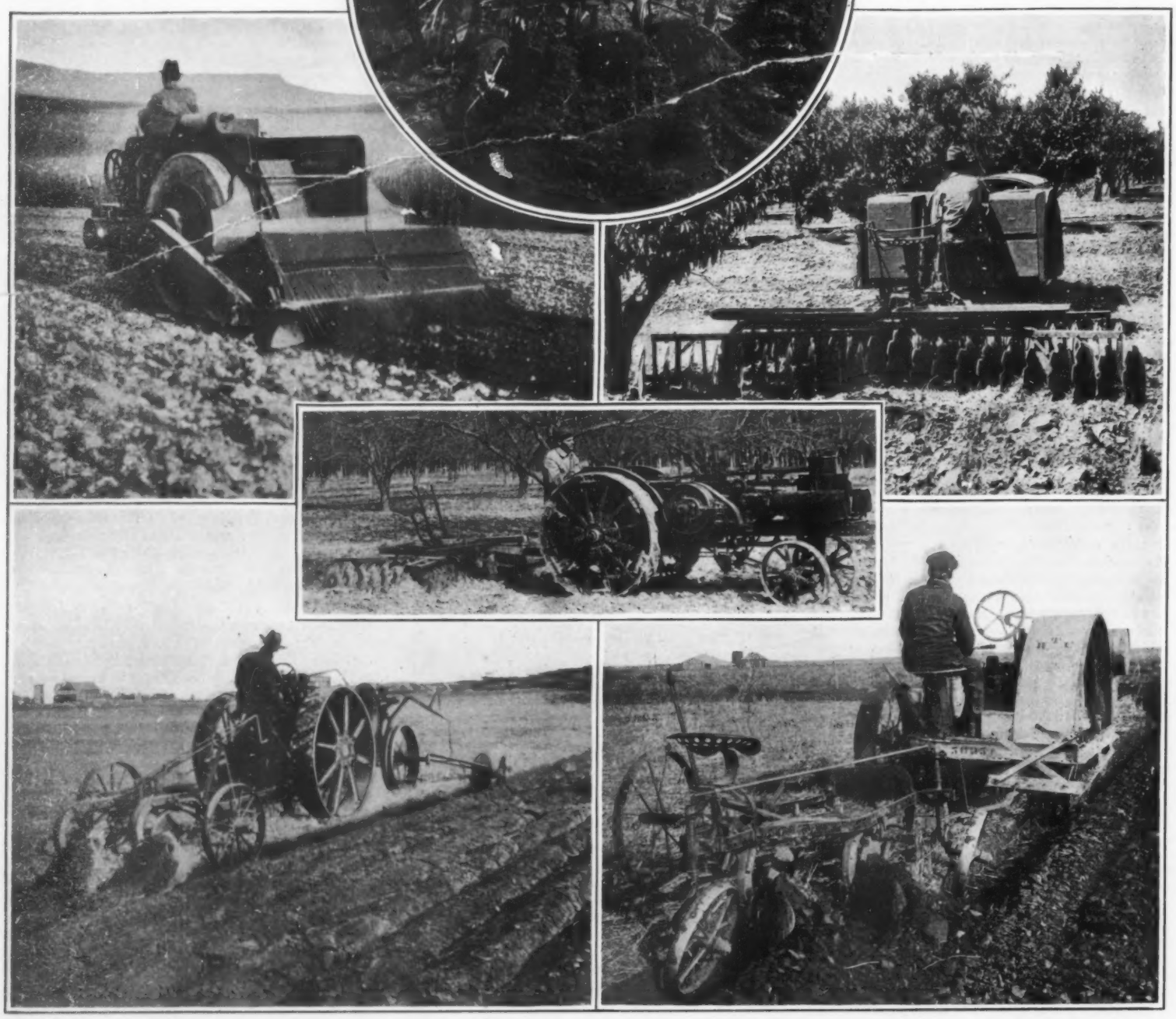
By L. W. Ellis, Vice-President, American Society of Agricultural Engineers

A Real Agricultural Need and What Engine Builders Are Doing to Meet it

A rotary soil cultivator or milling machine. A drum-like arrangement of flexible steel springs each carrying a flexible claw at the end is the interesting feature.



The bulk of tractors are built to draw plows or other implements in the rear. One tractor is arranged to receive a gang of plows attached directly to the rear, lifting it by motor power.



The majority of the manufacturers cling to the conventional round wheel type for their large tractors, but cast tradition to the winds in attacking the small tractor problem. The small tractors with two drive wheels in the rear and smooth tires fitted with some form of cleat are, therefore, in the minority. Width must be kept down in order to avoid side draft in plowing, also to permit the use of the tractor in vineyard cultivation. Height must, therefore, be kept down for the sake of stability; also to permit of orchard cultivation. The four-wheel drive has been tried with indifferent success. The single wheel is later, cheaper, and more promising. One large drive wheel, usually at the right side of the tractor, brings the power directly ahead of the plows, idler wheels opposite completing a three-point support.

PROGRESS IN SMALL FARM TRACTORS

THE scrap heaps of large tractor factories of solid reputation are strewn with small tractor failures. The Middle West has seen literally hundreds of minor concerns start, experiment away their capitals of $5,000 to $50,000 each, and quit, perhaps lasting long enough to sell a few engines at an attractive price and include the customers in the final disappointment.

The writer has positive knowledge of five absolutely different small tractors built and discarded by one big firm before it first placed the sixth on the market—that after a tractor building experience of a quarter century. Another firm, equally experienced, built seven models and spent three years in experimental work before issuing its first catalogue on a small tractor. These facts partially explain why the small tractor has been slow in coming—why the older, more substantial builders are now demanding prices that seem unreasonable in view of quotations made by smaller manufacturers.

The "average farmer," one operating not over 160 acres of land and keeping probably not over six work horses or mules besides young, driving and breeding stock, needs a tractor, one simple enough for him, his son, or the hired man to operate; light enough in weight to spare bridges and culverts; low enough in pressure per unit of ground surface to avoid packing his well-tilled land; powerful enough to replace at least five horses in plowing, thereby handling at least two plows; and price not to exceed the value of the horses which may be sold when the tractor comes to the farm to stay.

How these problems are being attacked Mr. Ellis sets forth in the following article.—EDITOR.

Building a small tractor is no child's play, but ten times harder than building a big one, even having the experience with the latter to start with. There are few rules and no precedents. Practical experimentation has done the most to develop what we have to-day, and the Middle Western professor of farm engineering was talking very sanely who said last summer that $1,000 was a minimum price for a reliable small tractor produced in present quantities. Without exception the tractors so far announced at sensationally low figures have either been materially increased in price or disappeared entirely from the market.

As to the final type of tractor for the small farm, the industry is in a too unsettled state to make predictions safe. From steam threshing engines to monster plowing steamers; from steam plowing engines and

mere self-propelling stationary gasoline engines to a fairly standard type of 60 to 75 horse-power gas tractor; then rapidly down the scale to the present wide diversity of small tractors, the range has been covered in fifteen years. The great gas tractor boom of 1911 and 1912 brought its reaction, as much from outside causes as from over-selling the market or disappointment in the product. Since then, the pioneer manufacturers have proceeded along more stable lines. Their offerings of small tractors have been few, but their types are good. Each week, meanwhile, brings out new names and new models, each valuable as a contribution to the sum of tractor experience, if not permanent in itself. The types discussed in the following paragraphs have been selected mainly to illustrate prevailing principles, and are not necessarily recommended in their present state.

The small tractors of note may be classified, for convenience, with respect to (1) power plant; (2) traction device; (3) kind and arrangement of tillage implements (this being the most influential factor affecting the design); and (4) special types. Outside of a few conventional designs, any combination of principle may be expected, and the coming of the ideal type will certainly not be delayed by any lack in this direction.

Motors.

Due largely to the great improvement of the automobile motor and the educational influence of the farmer's motor car, there is a distinct tendency toward the four-cylinder motor in the higher types of small tractor. While formerly considered more complicated and less economical of fuel, its advantages in lightness, flexibility and evenness of torque over the one- and two-cylinder motors are rapidly popularizing the four-cylinder type. One company specializes on small tractor motors and supplies a large number, especially for experimental machines and the newer commercial types. The well-established makers, as a rule, prefer to build their own motors, on account of both price and adaptability. It goes without saying that even small tractor motors are nearly all of a heavy duty type and usually of not over 750 to 900 revolutions per minute.

On the other hand, some of the largest makers retain the two-cylinder motor, twin and opposed types being in about equal favor. This results in a somewhat lower price and a considerable heavier type. The single-cylinder motor is seldom used for tractors as small as those we are considering, though attempts have been made to avoid excessive weight by running a small cylindered motor up to 500 revolutions per minute.

Ingenious Traction Devices.

The majority of manufacturers cling to the conventional round-wheel type for their large tractors, but cast tradition to the winds in attacking the small tractor problem. Small tractors with two drive wheels in the rear, and smooth tires fitted with some form of cleat or grouter, are therefore in the minority. Width must be kept down in order to avoid side draft in plowing, also to permit the use of the tractor in vineyard cultivation. Height must, therefore, be kept down for the sake of stability, also to permit of orchard cultivation. The permissible wheel dimensions are not always adequate for good traction, and variations from the conventional two-wheel drive are the rule.

The four-wheel drive has been tried with indifferent success. The single wheel is later, cheaper and more promising. One large drive wheel, usually at the right side of the tractor, brings the power directly ahead of the plows, idler wheels opposite completing a three-point support. This type is quite compact and easy to guide. One difficulty lies in the fact that there is no second driver to assist in case the one strikes a soft spot, as in a two-wheel drive having a differential that may be locked. Another lies in the individual design of one tractor, the drive wheel running in the furrow and undoubtedly creating a hardpan similar to the "share hardpan" formed by one horse's feet and the plowshare. One single-wheel type has the drive on the left side for greater convenience in harvesting with binders. Left-hand plows must, of course, be used with it.

The single driver idea is used in combination with an endless track, also in several self-contained motor plows. It is capable of being very cheaply constructed, and has been exploited on a large scale within the last year, the majority of makers aiming at a cheapness which cannot but react against the type, however good it may prove in the end.

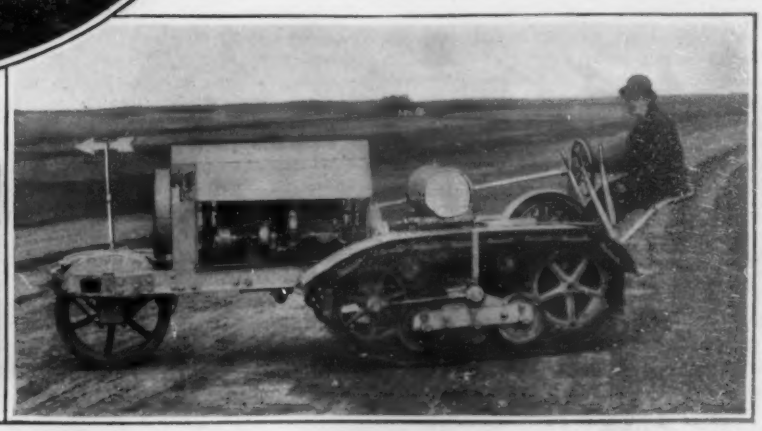
A number of builders have accepted the limitation as to size of driver and sought to make it more efficient by improving the gripping arrangement. Tires of open construction are used, also several forms of fixed paddles so arranged as to imitate the course of the horse's hoof as it enters and leaves the ground. The extra expense of construction is probably justified by the advantage in tractive efficiency. Spikes and spades arranged about an eccentric, appearing and disappearing automatically in some cases, and in others merely capable of being thrust out and withdrawn to give points, have been offered repeatedly, but have been discarded in practically every case because too complicated and too easily jammed.

Endless Track Types.

Another, and probably the most important, variation from the wheel type is that which substitutes a wheel with movable pedals jointed to the rim (not common in the United States), or else an endless apron, or track, composed of segments, either device affording much greater contact with the ground than the ordinary wheel. This class, frequently referred to as the "caterpillar" type (though the word "caterpillar" is a registered trademark applying to but one manufacturer's product), has come to the front very rapidly. While especially well adapted to large units, because the seg-

The small tractor which the average farmer needs must eventually do many things the big tractors did not do—that is cultivate vineyards or orchards, even corn and potatoes, perhaps; make more frequent trips to town with ordinary teamloads; and do odd jobs in odd corners about the farm. It must do many things horses seldom do in the way of running stationary machinery. And it must do or attempt practically everything expected of farm horse and giant tractor combined. Above all it must not be a fad or a luxury. It must pay its way, showing a low upkeep cost, reasonable operating cost, and sufficient versatility to keep overhead charges distributed over a maximum of working days per annum.
A one-armed man operating a small tractor is shown in illustration on left.

Harvesting is only one of the many tasks which will have to be performed by the small tractor. Indeed, so diverse are the applications of the tractor that one manufacturer calls his machine a steel mule.



The caterpillar type has come to the front very rapidly. Tractors of this type weighing less than six thousand pounds are easily doing the work of eight to ten horses.

PROGRESS IN SMALL FARM TRACTORS

mental track will transmit the power of an extremely large motor without requiring a corresponding increase in weight, it has peculiar advantages in small units as well.

The latest form of track consists essentially of (1) open-sided steel castings which form both shoes and connecting links; (2) steel sleeves and pins forming the joint between units; and (3) chilled truck wheels which roll upon the inner, rail-like surface of the links and carry the tractor's weight. The efficiency of this device in crossing soft ground and in avoiding the packing of the soil has long been recognized, but the multiplication of wearing parts has required careful choice of materials and good workmanship in avoiding an excessive unkeep cost. Authentic instances are now on record, however, to indicate that a well-constructed track should stand 5,000 to 8,000 miles of wear before renewing, and the matter of upkeep is, therefore, not serious. The higher first cost of this type is, of course, to be balanced against the ability to work under very unfavorable conditions.

The track is neither wide, nor high, but *long*, hence enormous traction is gained without violating either limitation to ordinary wheel dimensions. There is no slippage under ordinary circumstances, a factor which loses from 6 to 10 per cent of a round-wheel tractor's geared speed under normal conditions. The greater tractive efficiency naturally assists in keeping down the fuel consumption, but its particular advantage in the small tractor lies in its cutting out the side draft without unduly increasing the weight of the machine, and in enabling tractors of this type to climb surprising grades. Tractors of this type, weighing less than 6,000 pounds, are easily doing the work of 8 to 10 horses.

At least a dozen tractors now embody something of this principle, with certain variations as a concession to patent formalities. One maker substitutes two-inch balls for the truck wheels carrying the tractor's weight. One newer tractor uses but one endless apron instead of two. Practically all omit the differential gear and turn much shorter by means of separate friction clutches governing either side of the track independently. Infringement proceedings may affect the status of some models in this group.

Arrangement of Plows.

The bulk of tractors, large or small, are built to draw plows or other implements in the rear by means of rods or chains. One tractor is arranged, however, to receive a gang of plows attached directly to the rear, lifting it by the power of the motor. Others, both one- and two-wheel drive, become self-contained motor plows through gangs hung under the frame between front and rear wheels. These outfits have the advantage of being able to back up and turn square corners when plowing, thus finishing up corners somewhat more neatly and allowing the operator at will to plow around a field as with an ordinary horse plow. The main disadvantages lie in the fact that such an outfit tends toward either excessive height or excessive length, to accommodate the plows; in that the distribution of weight, if proper for plowing, is less efficient at other work; and that in case of miring there is no opportunity to disconnect the plows quickly and rescue tractor and plows separately. The self-lift plow threatens to lessen the opportunity for this type.

A tractor somewhat upon the order of the most popular type in Germany, but much smaller, consists of a balanced frame supported by two narrow drive wheels of large diameter. The motor forward balances the plows in the rear. Ease in steering, good clearance, and simplicity, are the main advantages.

Several years ago the writer was moved to remark upon the possibility of a power plant which might be attached in turn to various ordinary farm machines to make them self propelling. Such is the purpose of one manufacturer, who carries the motor upon a light, two-wheeled chassis, the operator controlling it from the seat of the implement drawn behind.

A type given considerable prominence about two years ago, but apparently so far lacking in some vital mechanical refinement, is the motor hoe, or cultivator, similar to the type just described, but carrying light tools attached, the whole guided by an operator who must walk and hold the handles.

Soil Milling Machines.

A final type, not yet commercially important, is a class of rotary soil cultivators, or milling machines. One of Swiss invention is now being manufactured in the United States. The interesting feature is the working tool, which consists of a drum-like arrangement of flexible steel springs, each carrying a flexible claw at the end. At a speed of 150 revolutions per minute the work of this tool is surprising, whether in hard, soft, foul or stony ground. Scratching the earth, rather than cutting, it pulverizes to a maximum depth of 12 inches and prepares a superior seed bed at one operation. From the agronomic standpoint the work is most excellent. Mechanically, considering only the tool, and assuming that the tractor and method of driving the tool are good, being conventional, there is only the question of replacements to springs and teeth to consider, as the work is satisfactory. Economically there comes the question of how many will (not should) introduce a tillage method which apparently consumes so much power (three acres a day—10 to 12 inches deep—is the capacity of a 1,400-pound machine similar to the one illustrated). But one trip over the ground is made, however, as against several with ordinary implements preparatory to planting, and it has been found that the working tool—not the drivers—actually propels the outfit while working. Crop increases, after all, should pay well for the extra cost of work. Other rotary machines, larger and less successful, have been made, but none of commercial importance.

The number and variety of small tractors is so great that this article has been able merely to touch briefly upon tendencies, general principles, and something of the present status of the industry. In the face of such evident disagreement as to the eventual type, the safest course in buying is to investigate all claims thoroughly, and insist that the product shall be past the experimental stage, and the firm behind it permanent and substantial.

The Windage of Shot

THE present hostilities in Europe have revived the old discussion as to wind-contusions caused by shot and shell and some strange stories have been told of men dying or seriously injured without external signs of wounds. The question that has been raised is, Can the displacement of the air caused by the passage of a projectile produce serious and even fatal organic lesions when a man is not struck by the shot?

It was customary in former days to attribute to this trauma without contact the most singular derangements and even sudden death. When, however, the French military surgeons of the republic and the empire carefully investigated the problem, the theory which attributed such results to the windage of cannon-balls and shells broke down before the analysis of the actual facts.

A physician, discussing the question in the Paris *Temps*, speaks of Larrey, the noted army surgeon of the era of the first Napoleon, who "showed, in the memoir he presented to the Surgical Society, that all that had been related of the phenomenon disappeared into the domain of legend or arose, rather from a wrong interpretation. After the appearance of this memoir the question was considered as finally settled and the treatises on military surgery during the nineteenth century disdainfully ignored it."

Nevertheless, the question so vehemently argued and rejected in days gone by has been brought up anew by the occurrences of the present war. Our author in discussing the problem under its present form says further:

"On one side and another facts are quoted which seem to compel us to acknowledge that disorders caused by the passage or the sudden sharp combustion of a projectile near a man are perfectly admissible. Messrs. Lannois and Chavanne have named to the French Academy of Medicine soldiers who have been made deaf, probably permanently, by the bursting of a shell near them. There are cases where an ordinary ball which only touched the external parts of the ear has caused a perforation of the membrane of the ear-drum that, however, remained outside of its direct action. Monsieur Sencert of Nancy reported to the Surgical Society, at one of its last sessions, the story of a man who died from having been in the immediate vicinity of the bursting of a shell of large caliber, although he was at least a meter from the point of explosion. The man was not even touched by a splinter of the metal, yet it was found that both lungs had burst. A fairly large number of similar facts have been related since the beginning of hostilities. Exact statements of the cases being lacking, more or less complicated reasons have been brought forward to explain them. There has been talk of fulminating poisonous gases disengaged by the explosion, of violent and sudden nervous concussions. Monsieur Sencert's account, however, shows that no such explanations are necessary, and that the sufficient reason in these cases, which are moreover unusual, is a mechanical effect that bears a strong resemblance to the wind-contusion of former times."

Perhaps, though, this resemblance is somewhat deceptive. Outside of the case of a ball which perforated an ear-drum without touching it, the question seems more one of analogy than of actual identity. The physician of the *Temps* in presenting this view of the subject says:

"The difference between the projectiles of to-day and those of former times is so great, their speed has increased so remarkably, and, above all, the combustible element has such great power, that the present testimonies hardly serve to explain the mysteries of past eras. We are obliged to-day to admit that the bursting of the formidable projectiles used by the armies must produce extraordinary differences of pressure and that necessarily, at least within a certain radius, these differences can induce lesions serious for the organisms which suffer them. This has now been proved, but in this alone is summed up for the surgery of the present war the problem of windage, the elements of which have varied to a singular degree since the days it was proposed for the first time and ever since the epoch when Larrey totally denied its existence."

Why a Whip "Cracks"

WHY does a whip "crack"? Probably the coachman most adept at the art would not be able to tell you. And no wonder. For the reason is one that has puzzled some of the greatest authorities on dynamics. An explanation was tentatively offered recently by Prof. C. V. Boys in the course of the series of lectures for juveniles at the Royal Institution. Briefly, it has to do with the fact that, owing to the action of centrifugal and other forces, the speed at which the whip travels through the air is greater and greater throughout its length, and so great at the end that it comes up to the velocity of sound.

"Mechanics in the Home" is the alluring title of the series of lectures, and by means of very interesting experiments the professor showed what are the principles underlying various every-day and, apparently, simple devices. Friction, for instance, is one of the greatest. To the wonderment of his boy and girl audience, Prof. Boys took some "safety" matches out of a "strike only here" box, and set them alight with the greatest ease on a glass bottle and a piece of mahogany. They thought it was a miracle, until the lecturer explained that the friction was sufficient to make the match get hotter and hotter until it flamed. But, be it added, the surface on which a "safety" match is struck must be perfectly smooth, otherwise the roughness will rub off the substance on the tip. It is friction, too, which prevents a wedge jumping out after the blow that has driven it into, say, a log of wood.

Apropos of "impact considered as a self-adjusting leverage in time," the boys learned why, when a cricket ball is hit too near the end of the bat, the hand is stung. It is because the impact, coming at that particular point, drives the bat up. Just as it did to both ends of a stick which, when the lecturer broke it by a sharp blow exactly in the middle, flew away in halves, leaving undisturbed two water-filled glasses on which it was resting.

Motion Pictures in Medical Schools

THE motion picture has invaded the realm of medical school instruction. The specialists in diagnosis have discovered that there is no other way in which they can so vividly present to medical students the difference in diagnosis between similar physical appearances as by means of the moving picture. Dr. J. Ivan Dufur, professor of nervous diseases at the Philadelphia College of Osteopathy, is the originator of this method of teaching which, it is believed, will revolutionize medical instruction. Dr. Dufur has, as the result of a year's labor, succeeded in preparing a set of reels, including demonstrations of actual cases of every one of the principal nervous diseases. Harrowing experiences were necessary in the preparation of some of these reels. Dr. Dufur and the photographer were locked for four hours at one time in a room with a dozen insane epileptics waiting for a characteristic fit.

The osteopathic practitioners are greatly interested in this method of diagnosis and these reels are being exhibited at State conventions of that school of practice and are being used in their colleges.

The Current Supplement

THE leading article in the current SUPPLEMENT of the SCIENTIFIC AMERICAN, No. 2048, for April 3rd, 1915, A Record of Achievement, is a discussion of what the chemist has contributed to the industrial development of this country of the utmost importance to every manufacturer and citizen, and its author is an acknowledged authority on the subject. Unloading Bananas tells of a rapid method of handling this delicate fruit from the ship to the railroad. Sherardizing describes a valuable process for rust-proofing metals. The Zeppelin Question gives many timely details relating to the size and capacity of these much-talked-of aircraft. The Influence of Radio-active Earth on Plant Growth describes some most interesting practical experiments on the application of radio-active material to agriculture. The Effects of Climate on the Location of Manufacturing Plants discusses an economic question that has not heretofore been properly appreciated by those who control industrial enterprises. The New Knowledge of Coal Tar is a most valuable explanation of scientific methods for the utilization of all the constituents of coal, many of which are now wasted. The article on Photographing Projectiles is concluded, and there are interesting articles on Gasoline Locomotives and Some Questions of Evolution.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

National Defense Approved

To the Editor of the SCIENTIFIC AMERICAN:

You are doing a most patriotic work in your advocacy of adequate national defense. The writer, while welcoming any expression of this idea, was a bit surprised to see this most vital matter referred to in no less an organ than the church calendar of one of the most powerful of our city churches. Leaven in such places is bound to work. H. A. FREEMAN.

Newark, N. J.

Origin of Khaki Uniform

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of February 6th, on page 124, the statement is made in the article "The Art of Deception in War," that "in the Boer war khaki first came into general use." This is not in accordance with facts. Khaki has been in use in the British army on active service for more than forty years. It was in use in the Jowaki Expedition in 1877. Again all troops (British and native) engaged in the Afghanistan war, 1878-79-80, wore khaki. Even the shoes were tan colored leather, sword belts and saber scabbards were tan colored leather, helmets were covered with khaki covers and puggarees. Buttons and buckles were not polished. The pomp of the parade ground was entirely absent. In the second campaign of that war, 1879-80, the carrying of colors into action was abandoned, they being left with the depots at the base.

By the way, khaki is a Hindostani word meaning brown. W. A. MAYES.

Mt. Penn, Pa.

Left Hand vs. Right Hand Drive

To the Editor of the SCIENTIFIC AMERICAN:

I notice in your issue of January 23rd an article by C. C. Blackmore, entitled "Left-hand vs. Right-hand Drive," in which he states that there is not a tendency for drivers of left-hand drive cars to "hog the road." With all due respect to Mr. Blackmore, I fail to see how he reaches the conclusions he does, unless conditions in Ohio are much different from what they are in and about New York. I have driven both right and left-hand drive cars, and speaking from personal experience, I must say that everything is in favor of the old right-hand drive. The only possible exception to the above is the town car, built exclusively for city use. On such a car left-hand drive is often convenient, but to my mind the difficulties of making a decent landing at the curb, or backing into place at the curb, more than outweigh any possible advantage.

For touring and general pleasure driving the right-hand drive is the safest and most convenient, and, moreover, it is a fact that drivers of left-hand drive cars, do have a tendency to "hog the road" in passing. The reason, I think, is obvious to anyone who has handled both kinds of car, and is briefly as follows: The driver of a left-hand drive car can see perfectly just how much room he has in passing a vehicle moving in the opposite direction, but what he *cannot* see is just how much room he has between his right wheels and the edge of the road, which more than likely is soft, or even unsafe. The result, and it is a perfectly natural one, is that he turns out *only* just enough to clear the approaching vehicle, and more often than not leaves from two to three feet of good road on the right, while the clearance on the left is a matter of inches.

The driver of a right-hand drive car can see exactly how much room he has on the right, between his car and the edge of the road, and so he knows just how far he can safely turn out in passing. He cannot see so well how much room he has on the left, but he knows from the width of the road that if he hangs well to his own side there is plenty of room. The result is that he turns out to the right, not as in the case of the left-hand drive, only just enough to clear the approaching vehicle, but as far as he can, and passes the vehicle on his left by a safe margin.

There is probably some psychology involved in this reason, which may be stated as follows: When a driver has to pass two things simultaneously, whose exact position in reference to himself he can see with different degrees of exactitude, he will naturally tend to pass the one he can see the best, by the smallest margin, in order to allow as much room as possible, and thus be on the safe side, in passing the other obstacle whose position he cannot see so clearly. The two things to be avoided are of course the approaching vehicle, and the edge of the road, which may contain a fence, tree, telegraph pole, or may be soft or otherwise dangerous. For this reason a driver of a right-hand drive car will avoid the other vehicle, and pass well to the right, while the driver of the left-hand drive car will avoid the edge of the road, and "hog the road."

There are many other things that could be said in favor of the right-hand drive, but the article I refer to in your issue of the 23rd instant only treats of hogging the road as applied to right and left-hand driven cars, and so I will limit this communication to the things mentioned therein. I feel certain that if an investigation were started, based on actual observation and inquiry, the great majority of cases would turn out as I have stated. O. B. POTTER.

Ossining, N. Y.

Nature Our Most Available and Reliable Ally

To the Editor of the SCIENTIFIC AMERICAN:

The only life-sustaining element that man cannot use to excess is air. To provide for its purity and make every breath a fresh one, the warmth of the outgoing breath instantly escapes upward, and is Nature's bar to suffocation. Medical inhalation would be impossible apart from its being ingrafted upon the breathing function.

When anesthetics were ingrafted upon the breathing function in 1846 there was no recognition of Nature's protection against suffocation in the outgoing breath. because of its warmth. In fact, so little thought has been given to this wise provision of Nature, that a vast majority of our most intelligent citizens are unable to tell why every breath we take must be a fresh one. Is it strange, then, that when the inhalation of ether and chloroform was ingrafted upon the breathing function, this natural law should have been entirely ignored? That it was and has continued all these years, constitutes the most thoughtless misconception of natural law of the century.

In June, 1898, a specialist became impressed with the idea that all drugs used by inhalation should be normally diluted with air, so that the medical effects should be added to the ordinary life-sustaining breathing function, and he made the drawings for a glass device that, by the shape of the bulb and direction of the internal air tubes, should cause a revolving current of air over the medicament within, thus diluting the medication with the natural amount of air.

This device was taken to the annual meeting of the Massachusetts Medical Society and exhibited with anesthetics in them for the first time. They created much interest and surprise that, though open at both ends, there was no escape or odor of the ether or chloroform, from which we ascertained that in a temperature of 70 to 71 deg. Fahr. the atmospheric pressure held in check the expansive, evaporative force of these anesthetics. Using this as a basis, it was found that each additional degree of heat increased their expansive, evaporative pressure one pound, which, with the automatic revolving current of air, have proved to us that the nausea, vomiting, pneumonia, and deaths following anesthesia were due to our neglect to dispose of the outgoing breath as Nature has done in the function of breathing, and not, as we supposed, by the anesthetics themselves.

By its producing the conditions of natural sleep, it shows us that the natural action of anesthesia embraces only the functions under mental control, and does not interfere with the automatic action of the striated muscular fibers of the heart and organs that sustain life when we are unconscious. It has also shown that ether bears the same effective relation to chloroform that light wines do to whisky and brandy, and that the visible effect of anesthesia upon the human system is much the same as intoxication, only the recovery from anesthesia was as complete in as many minutes as it took hours from alcoholics.

The presentation of these facts has changed the medical conviction so long announced by our Government, that "chloroform was a dangerous drug, and never should be used save by a physician or in his presence," to allowing its sale at any drug store in America, to anybody without reference to a physician or his order.

No remedy known to man so uniformly and quickly relieves suffering, and it is the *only one* that suspends its own use as soon as relief comes. Its wonderful power of producing muscular relaxation is likely to revolutionize the treatment of spasmodic affections.

Boston, Mass. WILLIAM B. HIDDEN, M.D.

Troops to Guard the Coast

To the Editor of the SCIENTIFIC AMERICAN:

In the February 6th issue of the SCIENTIFIC AMERICAN, on page 120, attention is called to the need of "coast guard" troops which will be necessary to guard the approaches to our cities, the coast defense works at and about our harbors, this force being estimated at nineteen divisions or about 380,000 troops, of which 275,000 will be required on the Atlantic coast.

The writer would like to call attention to the fact that there is no distinction between the "coast guard" as used in the article referred to and the "mobile army." Coast guard in this sense is a misnomer, as the term is already in use by the Government in connection with the Life-Saving Service. Its use as applied to a part of the national defense should be discontinued, as it gives rise to misunderstandings and false impressions in the public mind. The only "coast guard" in the military sense is the mobile army; and the only coast guard we should have or need is a well-organized mobile army, fully equipped and trained to move at a moment's notice to any threatened point or points. The national defense comprises three elements, viz.: the navy, the mobile army, the coast or harbor artillery. If the navy be defeated, eluded or bottled up, an enemy is free to land anywhere on our shores that it pleases him, except in the fortified harbors. The only defense against such a move is a mobile army. The other coordinate arm of defense is the coast, or more properly, harbor artillery, whose rôle is strictly limited to the water approaches of our fortified harbors.

If one will consult the "Report on the Organization of the Land Forces" published by the War Department in 1912, he will find therein the most perfect plan for organization of our land forces ever promulgated. It is the result of years of conscientious labor and study by the General Staff of our needs for adequate defense, and it is a most satisfactory compromise between the demands of the military ideal on the one hand and our national traditions of a small standing army on the other.

As is well known from the reports in the press, there has been drawn up, by a committee of the General Staff, a measure in form for legislation which puts into practical form the provisions of the "Report on Organization of 1912." It is this measure which Senator Chamberlain gave notice to Congress and the people that he would call for at the next session, and is the first comprehensive measure ever offered to Congress in the line of legislation for the land forces. All branches and arms are considered and provided for—mobile army and coast artillery—and the first step toward putting our defenses in a state of reasonable preparedness should be to enact this General Staff measure into a law.

The greatest defect in our land defense is the lack of organization of the mobile army. The writer of the series of articles now running in the SCIENTIFIC AMERICAN clearly demonstrates that point, and the urgent need of a reasonable increase in the numbers of both branches of the land defense. The mobile army, however, is the "coast guard" as he uses the term. We have no other use for a mobile army than just that, so far as it is to be used against an enemy; certainly not for one of the size he mentions. If we ever have occasion to use it otherwise we must of necessity be in such a position, so far as our enemy is concerned, that we shall need no coast protection.

In view of the importance of this question of our preparedness, or lack of it, to meet any reasonable danger which may confront us as a nation, it is suggested that a study of the advice of the military experts whose business it is to provide for our defense and to advise Congress of the necessary requirements in men and money will enable the layman to decide for himself what is our most pressing need at this time. For this purpose, it is imperative that the measure prepared by the General Staff for this very contingency be placed before the people in Congress at the earliest possible moment at the coming session. It is the duty of every citizen to make it his business to see that his Representative in Congress shall support the measure above referred to and see to it that it is enacted into law without delay. TILDEN BLODGETT.

New York.

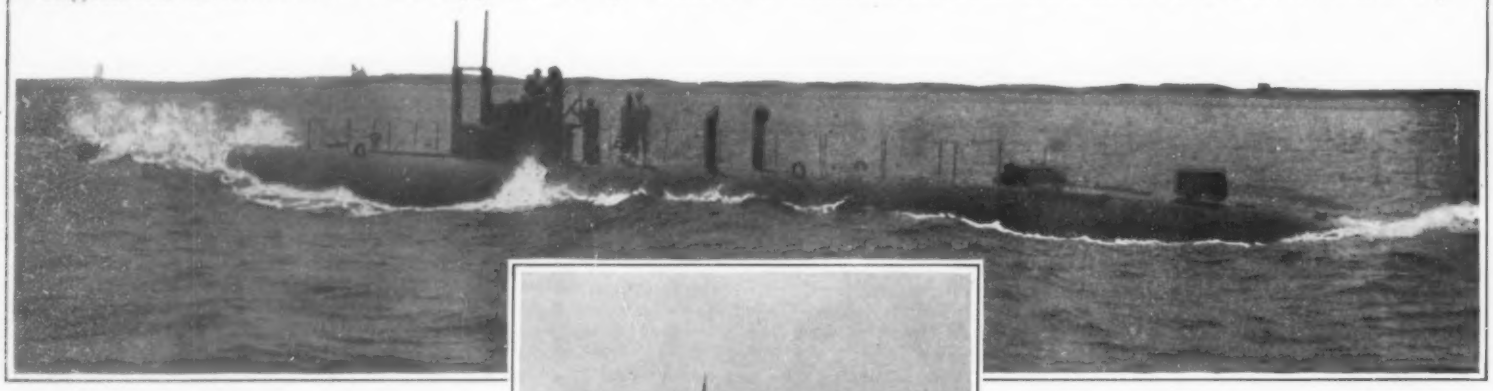
[There is a very distinct line of demarkation between the coast guard troops and the mobile army. The coast guard troops comprise some nineteen divisions when brought to full strength, and will be stationed in the vicinity of cities, naval bases, etc., and are intended as a defense against raiding parties from fleets.

A modern fleet is capable of landing several thousand men; it will be impossible to split up the mobile army (field army) with a view to protecting these many different points, all liable to attack by landing parties from the rear, and no portion of the 500,000 men less 40,000 coast artillery (approximately) could be sent to different seaports as coast defense troops without seriously crippling the field force. If this was attempted more than half the field force referred to above (500,000) would be required for this duty on the Atlantic coast alone. It will, therefore, be necessary to organize some nineteen coast guard divisions of all arms for this work, if both coasts are to be covered simultaneously.

While coast guard troops are mobile troops, they are not organized into field armies, but are stationed in the force needed at the various points liable to attack. The organization of these troops is not in conflict with the organization of the land forces, but is a force which must be organized in addition to the force of 500,000 therein referred to, if important coast cities, harbors, naval bases, etc., are to be securely held.—EDITOR.]

The Submarine at Sea

Ingenious Construction and Appliances by Which the Submarine Has Obtained Its Present Efficiency



The United States submarine "G-2" running full speed at the surface.

ALTHOUGH there are various well-known types of submarine, they all have certain fundamental features in common. The present description applies broadly to any of the vessels of this type, but more particularly to those which at present compose the majority of the vessels of this class in the United States Navy.

The form of hull is generally described as cigar-shaped. It is built of the very best quality of mild steel, and the workmanship is of the highest order, for the reason that every seam and rivet must be perfectly tight, in view of the service which the boat is called upon to perform. Not only do vessels of this type undergo all the stresses of sea and weather which other vessels are subjected to, but, in addition, they are required to navigate at considerable depths below the surface of the water. At these depths the pressure of the water is great, so that the hull must be made sufficiently strong to withstand it.

About five years ago it was considered that the most efficient size for a boat was about 140 feet long and 14 feet in diameter. With such dimensions, a boat was built which fulfilled all requirements which the naval authorities of the world demanded from it. That is to say, it could cruise on the surface for long distances at a speed of fourteen knots. At lower speeds its radius of action extended to several thousand miles. Several boats of this class are in service in our Navy. For submerged work large storage batteries are provided, which furnish energy sufficient to drive the boat from ten to eleven knots for a period of over an hour. The same electrical energy will drive her at a lower speed for a much longer time. The later submarines are much larger. The "G-4" type of 1912 are 157 feet long by 17½ feet diameter and carry four 18-inch tubes. The Electric Boat Company have under construction a fine type, of which we give an illustration, which is of 265 feet length, 23 feet beam, with a surface speed of 11 to 15 knots and a maximum speed of 20 knots. The radius of action is from 3,500 to 6,000 miles, according to the speed. It will be armed with four torpedo tubes at the bow, two at the stern, and four on the deck, and it carries fourteen torpedoes.

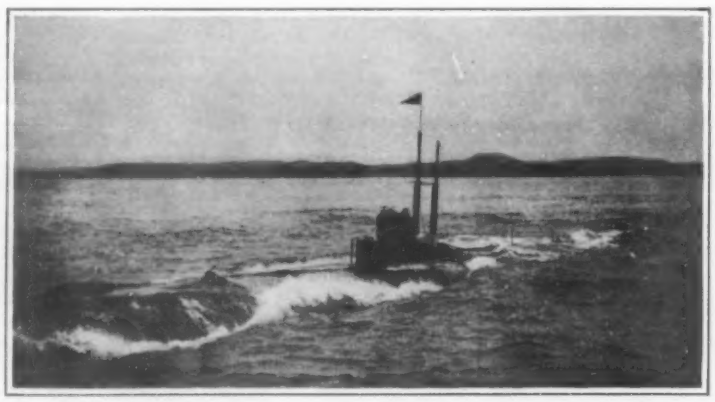
There are two distinct conditions in which the boat may be used. In the first, commonly known as the surface condition, the boat is prepared for cruising. A considerable portion of her hull is above water, a removable navigating bridge is in place, and she is driven by large, powerful, internal-combustion engines. Under these conditions she is managed in about the same way as any vessel built to run upon the surface. As for sea-going qualities, our submarines have been found in practice to be excellent. In ordinary weather they are fully as comfortable as any surface craft of the same dimensions, and even in the heaviest weather they are entirely seaworthy.

The second distinct condition exists when the boat is submerged. To pass from the surface to the submerged condition, certain valves in the interior of the boat are opened. This allows the water from the sea to run into great tanks built within the boat, and thus virtually sink her. These tanks are closely gaged, so that just the required amount of water is taken in. Under normal conditions, when the boat is at rest with the ballast tanks filled, she will have a few hundred pounds reserve buoyancy, which is represented by the top of her conning tower protruding above the water. If desired, this buoyancy may be entirely destroyed by admitting a small additional amount of water, equal in volume to the volume of that part of the conning tower above water. While in the submerged condition, all communication with the outside atmosphere is necessarily cut off. The crew then breathes the air contained in the body of the boat. The amount of air originally contained within the hull is sufficient to support life with comfort at least twenty-four hours. But, in addition to the air thus contained, the boat carries a large supply of compressed air in steel flasks, which, if used for breathing purposes, would be sufficient for a number of days.

Driving into a choppy sea.

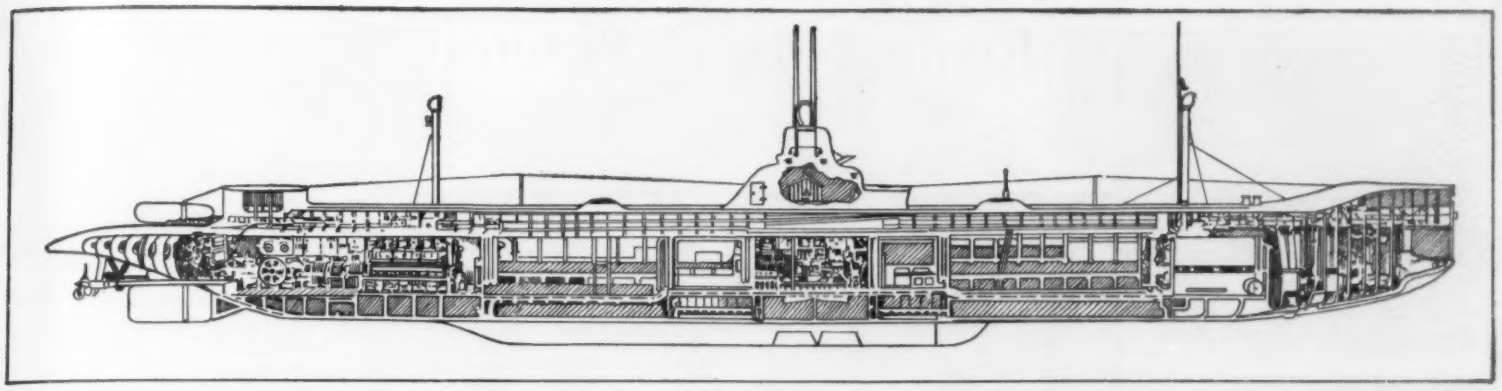
After having brought the boat to the submerged condition in the manner above described, powerful electric motors are started by throwing in a switch. These motors derive their energy from storage batteries contained in the boat and drive the propellers. The same storage batteries furnish current for numerous auxiliary motors used for pumping, steering, handling torpedoes, etc. The motion of the boat when under way is controlled by two sets of rudders; one of these sets, known as the vertical rudders, directs the boat's course to port or starboard just as does the rudder of an ordinary ship. In addition, there are provided horizontal rudders, which serve to control the motion of the boat in a vertical plane; that is to say, the depth at which she runs is regulated by these rudders. For steering in the horizontal plane, instruments are provided, so that the boat may be navigated with the same degree of accuracy as boats on the surface. The first of these instruments is known as a periscope. This consists of a vertical tube which extends from above the surface of the water to a few feet within the submarine. At the top of the tube is an object glass; at the bottom an eye-piece. Two reflecting mirrors, one at the top, the other at the bottom of the vertical tube, cause the image to be transferred from the object glass to the eye-piece. The operator can turn the periscope so as to sweep the whole horizon. To the writer, who once made a five-hour trip in one of our boats, the view was as clear as though he were at the surface looking through an ordinary field glass. Hence, when running submerged with the top of the periscope just out of the water, the navigator can see by day with perfect ease surrounding objects. If for any reason it should be desired to run at a still greater depth, compasses are provided by which the course may be steered with accuracy. For steering, submerged, in the vertical plane, instruments are provided which in a way take the place of the compass. One of these is a large pressure gage, which indicates the depth at which the boat is running. Another is a form of spirit level, which indicates the inclination of her axis. By the use of this, the man controlling the horizontal rudder is able to run at a perfectly even depth. While in the submerged condition, the boat is, of course, amply illuminated by electric lights. There are no ports or windows in the boat, and, so far as sensations are concerned, one is unable to determine whether he is running on the surface or submerged.

The arm of the submarine is the automobile torpedo. A number of these may be carried. They are discharged through tubes located in the bow or stern of the boat. Any type of automobile torpedo may be used. In view of the fact that the submarine is enabled to approach, unseen, to within a few yards, if desired, of the most powerful battleship, a long-range torpedo is not required. For this reason the weight devoted to motive power in the ordinary torpedo may be largely used to increase the charge of explosive, so that the destructive power can be made much greater for this particular type. Thus, the weapons used by the German submarines are credited with using the enormous charge of 420 pounds of explosive, and their range is about 1,200 yards.

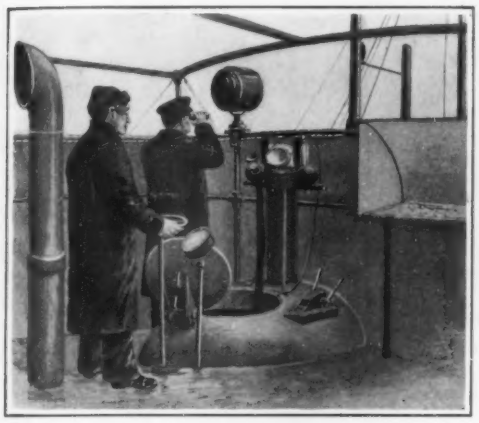


Lifting to a sea while running awash.

The present war afforded the submarine its first opportunity to exhibit its powers of offense; and it must be admitted that it has more than vindicated the faith and patience of its inventors. The roll of its victims is formidable. Early in the war a single German submarine, "U-9," sank within the hour three large British 12,000-ton armored cruisers. Later, a British battleship was torpedoed and sank in the English Channel. To this must be added a Turkish battleship and a long list of smaller cruisers and merchantmen.

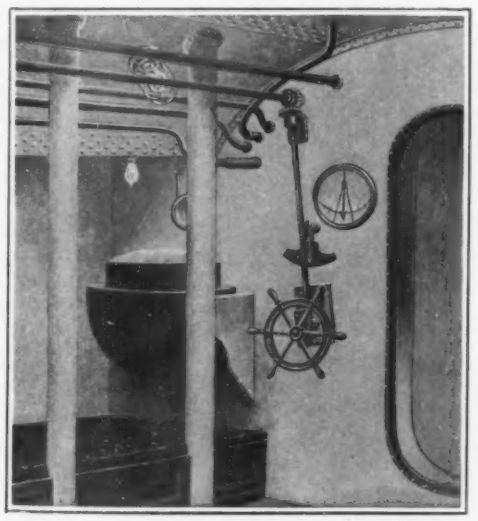


Longitudinal section through a typical German submarine.



The bridge of U.S.S. "G-2."

As fitted for surface cruising. This structure is made of portable parts, floor, stanchions, rails, steering wheel, compasses, chart table, searchlight and ventilator, all of which can be removed in a short time and stowed below decks or in the hollow superstructure, leaving nothing but the bare conning tower, as shown in the photographs.



The navigating compartment of U.S.S. "G-2."

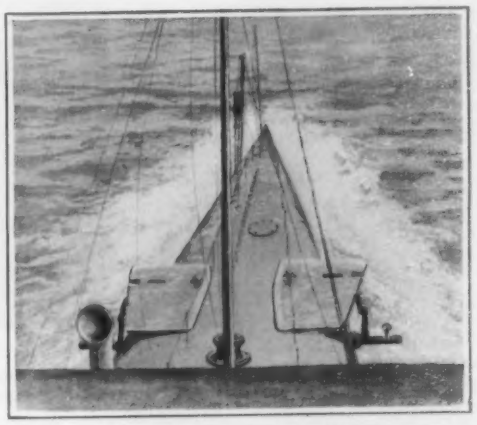
In this space all controls of the submarine are located. Our illustration shows the gyroscope compass, the steering wheel, the rudder indicator, and the indicator showing the roll of the vessel. The door leads into the torpedo room. In a very small amount of room a remarkable number of instruments must be ingeniously disposed in this manner.

Teak Wood

THE consumption of teak has increased considerably during the last two decades. Besides its extensive employment in ship building in England and the manufacture of railway carriages in India, it is now used in increasing quantities in Europe for building purposes. The recent rapid growth of the European fleets has caused an enormously increased use of teak in spite of the marked tendency to employ as little wood as possible in the construction of warships. About 1,000 tons, or approximately half a million board feet, of the best grades of teak are used in the construction of a modern man-of-war. In order to replace the ships which have thus far been sunk or otherwise destroyed in the European war, hundreds of millions of feet will be required. This increased consumption of teak which is bound to follow the close of the present war, cannot be met by Burma and Siam. Formerly Burma alone supplied all the teak used by the English Admiralty, because it was considered better than that from Siam, but the demand for teak from both sources is likely to be very great, not only in Europe, but also in America, and prices are apt to rule very high.

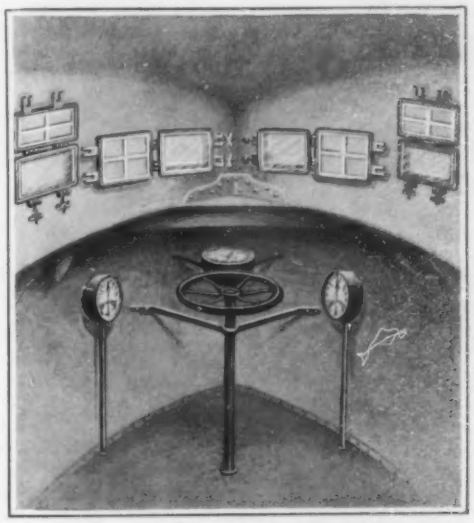
Loco-weed Poisoning in Sheep

AS is well known, great uncertainty has always attached to the nature and precise origin of the so-called loco disease, which is commonly regarded as one of the great scourges of the Western cattle ranges, and is attributed to eating certain species of the genera *Astragalus* and *Aragallus* known as loco-weed. A recent contribution to this subject by H. T. Marshall, published in the *Bulletin* of Johns Hopkins Hospital, is based upon experiments in feeding *Aragallus spicatus* to sheep in Montana. The author finds that none of the abnormalities encountered in the sheep could be attributed to the weed, but were due either to insufficient food or to forms of parasitic infection. He is convinced that "there are several diseases of Western live stock masquerading under the general name 'loco disease,'" and says further, "I, therefore, think there is reason to be doubtful as to the existence of pure, *bona fide* loco-weed poisoning, and I hold that it is perfectly certain that the heavy losses attributed to loco-weed disease are at least in large measure due to other causes." These conclusions are not in accord with those of the *Bulletin* on loco-weed disease published a few years ago by the Bureau of Animal Industry, in which it is stated that "there is no longer any question in regard to the poisonous properties of the loco plants," and that the opinions prevailing among stockmen as to the symptoms of loco disease are quite correct. There is much other literature concerning this disease, access to which is most readily obtained through the indexes of the Experiment Station Record.



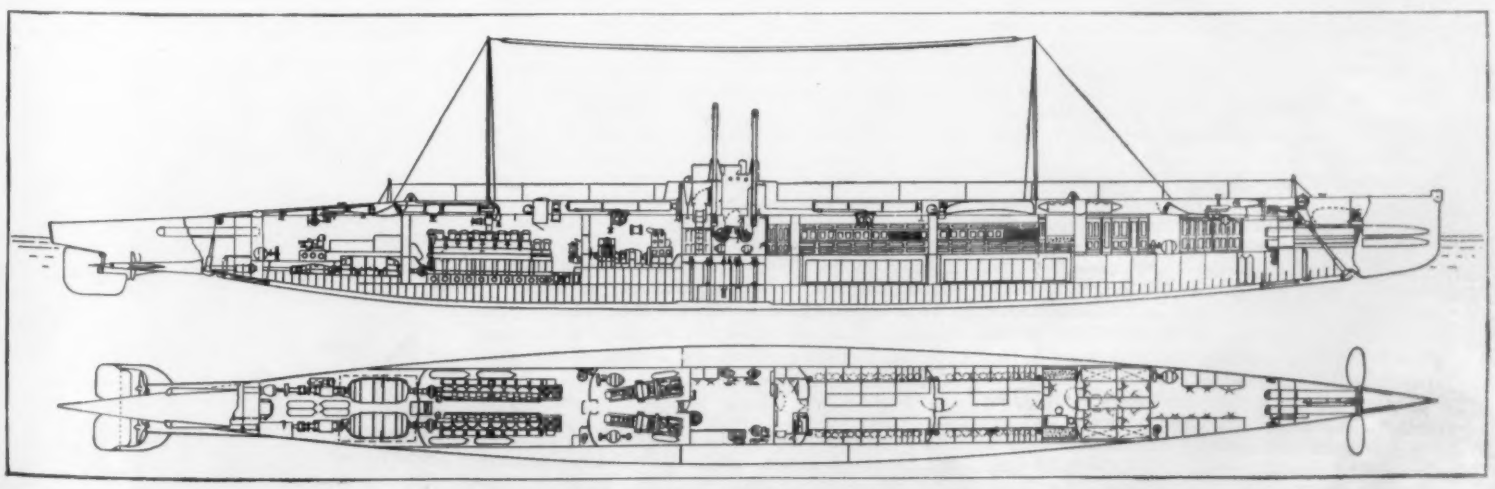
Forward deck of U.S.S. "G-2."

Showing two of the lateral planes or diving rudders bolted to the deck for surface running. The planes when operating for submerging are folded outward and the horizontally on a shaft which is controlled from either the conning tower or operating room. The wireless mast is portable, and when the vessel is in submerging trim is lashed to the deck.



In the conning tower of U.S.S. "G-2."

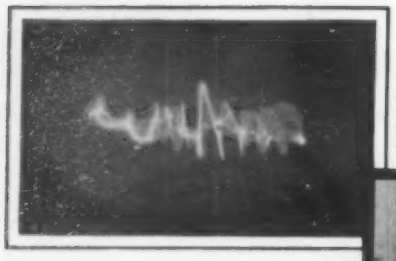
In this small compartment are duplicates of all gages, indicators, and operating devices with tell-tale connections to the main operating room. In the forward end, as shown, are four windows which give the navigator when the boat is running awash a view of the horizon. When totally submerged these ports are protected by steel shutters which are screwed tight.



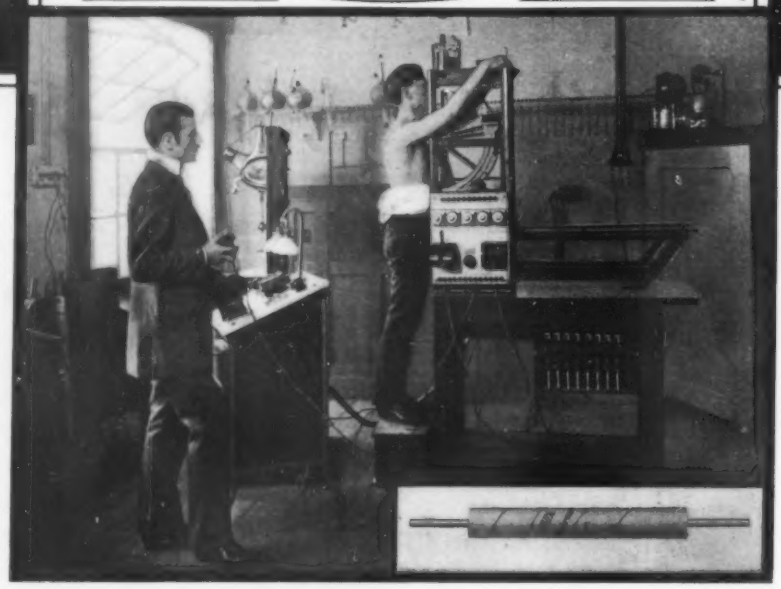
Longitudinal and plan views of a submarine of the Laurenti type.

Röntgen Motion Pictures

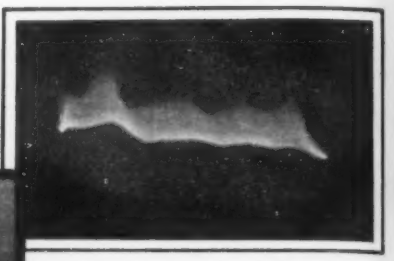
The Remarkable Dessauer Process



In a magnetic field the secondary discharge acquires a spiral shape.



Dessauer's apparatus for taking eight snap-shot X-ray photographs per second. At the lower right-hand corner one of the "lightning cartridges," by means of which the sudden discharge through the Röntgen tube is produced.



The violent secondary discharge is like a long flaming tongue of light.

THE older forms of apparatus for preparing X-ray photographs of parts of the human body made use of a continuous discharge vacuum tube, and a more or less prolonged exposure of the photographic plate.

While this method is satisfactory enough for diagnosing fractures of bones, for example, it has a very obvious drawback when applied to most of the internal organs of the body. Some of these, as the lungs, the heart, and the alimentary canal have a proper motion of their own. Others, like the liver, follow the rhythmic contraction of the diaphragm. In all such cases a "time" exposure can give only a blurred image of the general shape of the organ, and fails to show sharp outlines. This defect is serious enough if all that is wanted is an approximate picture of the particular organ under examination. It is a complete bar to success if the actual motion of an organ, such as the heart, is to be observed. One of the first to point to this defect in the older method of X-ray photography was Dr. P. H. Eijkman of the Hague. Dr. Eijkman was making a radiographic study of the movements of the pharynx in the act of swallowing. With great patience he succeeded, by special devices, in obtaining the required views. But, as he pointed out at the time, the whole process would have been immensely simplified if he had had at his disposal means for taking a rapid succession of snap-shots.

The matter was taken up by Friedrich Dessauer of Frankfurt a/M., director of one of the largest X-ray tube works in the world, and well known for his valuable contributions especially to the applications of physics in therapeutics and surgery. Our readers may recall that we recently (SCIENTIFIC AMERICAN, July 11th, 1914, p. 30) had occasion to refer to his latest achievement, the production by means of an X-ray tube, of radiation practically identical with the gamma rays of radium.

It is most instructive to follow somewhat in detail the principles involved in the problem of X-ray kinematography and the argument followed by Dessauer in its solution.

It should be explained that, in order to produce the required effect upon a photographic plate, it is necessary that a certain definite amount of energy reach the plate. Now with X-ray tubes as ordinarily employed, it required about one thousand impulses from the machine to furnish the requisite energy. The problem, then, was so to increase the energy of the discharge that a single impulse was sufficient to produce the image on the plate.

It is interesting to observe how this is accomplished by Dessauer. In the first place a very powerful induction coil is used. In ordinary practice a coil having an iron core weighing a few pounds is considered large. Dessauer's primary core weighs three hundredweight.

Now a core of this size requires an exceedingly heavy current to energize it, some 250 to 300 amperes. The problem, therefore, arises, how is this current to be drawn from ordinary electric mains? At clinics and private laboratories 20 to 40 amperes is usually about the limit of current available.

The way out of the difficulty is found by considering the time factor. The iron core requires four one hundredths of a second to be energized. If precautions are taken that the current shall under no circumstances last for longer than four hundredths of a second, it can, without damage to any part of the circuit, be taken from the ordinary electric mains. At the same time it is very essential that the interruption of the current be made as abrupt as possible.

These were the principles upon which the solution of the problem was based, and the Dessauer "lightning cartridge" constructed. The idea is to cause an explosive disruption of the circuit immediately after it is closed. The cartridge consists of a fine metal wire, one third of a millimeter thick, embedded in a plaster of paris matrix. When a heavy current is allowed to pass through this, the wire does not melt, but is gasified with explosive violence. This cartridge is inserted in series in the primary circuit of the induction coil. Measurements made on an apparatus of this construction showed a current of 400 milliamperes in the secondary. Ordinary X-ray apparatus employ a current of at most 10 milliamperes. The spark from the secondary is exceedingly violent, resembling a flame in appearance. If allowed to pass within the magnetic field of the primary it assumes a spiral twist as shown in our headpiece on the left.

The problem of X-ray snap-shot photography being thus solved, it now remained to construct an apparatus for making a number of exposures in rapid succession after the manner of the moving picture process. It was decided to use plates, and considerable difficulties were encountered in providing for the rapid intermittent motion of the parts, while yet avoiding all jerks. Finally, a device was evolved, which is shown in our central engraving at the head of this article. The plate is allowed to swing into place with a pendulum motion, and the exposure is made through automatic contacts at the moment when the plate hangs in its vertical position. This arrangement is preferable to one in which the plate moves laterally through the field, for any slight motion which takes place during exposure is in the direction in which the X-rays hit the plate, and, therefore, has practically no disturbing effects upon the definition. After exposure the plate falls down a chute, making way for the next plate to be exposed. Eight plates can thus be exposed in rapid succession in one second.

Some idea of the requirements to be met in photographing physiological subjects can be gained from an example. The heart normally beats about seventy-two times a minute, or in other words, completes one cycle in 0.85 of a second. As a matter of fact the contraction (systole) of the heart is much more rapid than its expansion (diastole), lasting only about one twentieth of a second. Inasmuch as some parts of the heart move through almost an entire inch, it will be seen what rapid exposure is needed to obtain a sharp representation of its action. One of our illustrations shows six exposures of the beating heart made during one cycle by the Dessauer process. Another set of photographs reproduced on the opposite page shows a kinematographic study of the act of swallowing. The photographs clearly show the motions of the food, of the tongue bone (hyoid bone), and the epiglottis (a cartilaginous lid that covers the larynx in swallowing, to prevent food from "going the wrong way").

It is needless to point out that X-ray pictures thus taken in rapid succession can be combined to reproduce as a moving picture the motion of the organ studied.

Itakolumite, a Flexible Stone

WE are so accustomed to think of stone as something perfectly rigid—"hard as a stone" is a common expression—that it is difficult to conceive of a stone that is as flexible as India rubber. It is generally known, indeed, that thin sheets of mica and threads of asbestos possess some degree of flexibility and elasticity, but a thick stone plate that bends under its own weight is a rare and striking phenomenon, that is exhibited only by certain varieties of itakolumite. "Itakolumite," says *Prometheus*, "is a yellow or pale red sandstone of slaty structure, containing many little plates of mica, grains of talc and chlorite, and extremely fine particles of feldspar, with traces of iron pyrites, magnetite, and pure gold. It is the mother rock of Brazilian diamonds. In Brazil itakolumite is found in great masses, resting upon gneiss and associated with crystalline slates. Not all itakolumite is flexible. The flexible variety was first discovered in 1780. In view of the well-known properties of mica it is natural to ascribe the flexibility of itakolumite to the mica which it contains. Not a trace of flexibility, however, is exhibited by some varieties of itakolumite that contain very large proportions of mica. When flexible itakolumite is cut into thin plates and examined with a microscope it is found to be composed almost entirely of fine grains of sand of peculiar shape, with indented edges, which interlock like the fingers of the clasped hands. The flexibility of the material results from this interlocking of the grains of sand of which it is chiefly composed.

"A plate of itakolumite set on edge sways to and fro like a piece of leather. A thick plate supported at both ends bends so that it becomes concave above; if it is supported at its middle it becomes convex above. Smaller plates, an inch or more in thickness and 6 or 8 inches long, can be bent with the hands like strips of India rubber."

More Mysteries of Ultra-violet Light

By Dr. Leonard Keene Hirshberg, A.B., M.A., M.D. (Johns Hopkins)

EVER since Prof. Becquerel showed the wonders of ultra-violet light, the science of physics has steadily day by day added more and more wonderful knowledge to the subject.

It was until recently thought that the curious chemical action of the ultra-violet radiations were peculiar to it; that negative and films and photographic plates were acted upon solely by the chemical powers of the ultra-violet light. Now, however, it is known that red, blue, infra-red, yellow, green, and the other kinds of light all have chemical powers of more or less strength. These chemical influences will also act upon a film or plate and yield a photograph.

Recently much credence has been given to the proposal of such distinguished savants as Prof. Svante Arrhenius of Stockholm and Dr. Thomas S. Blair of Philadelphia that cosmic dust, shooting stars, meteors, comets, and the like carry life from planet to planet. That the germs of life of minute animals and plants have their origins in some such fashion as that.

Now it is known that the ultra-violet rays when directed for varying periods of time from an hour to several hours will kill all life. It is also realized and admitted by all physicists that outer space is permeated by ultra-violet light.

Therefore, say many who jump quickly, at conclusions, it is manifestly impossible for life to be transmitted from planet to planet and star to star as these noted investigators maintain.

Yet stop a while! Newer investigations just announced by the illustrious Dr. Alphonse Berget show that Dr. Blair, Prof. Arrhenius, Dr. Ecree, and others who hold that the specks of life are thus sent by the Creator from star to star are feasible in every way.

Ultra-violet light like gravitation is weaker and weaker the farther you get away from any spot. Therefore, 93,000,000 miles of separation between the sun and the earth weakens the ultra-violet rays very much. More-

Friedrich Dessauer.

over and this is the important point, the ultra-violet rays really act by "rusting," "burning," or "oxidizing" the things acted upon. That is to say they kill and exert a chemical action by virtue of the oxygen in the air.

Since there is no oxygen or atmosphere out in space, since it takes some hours for ultra-violet rays to kill; since also a meteor full of life bursts through the atmospheric corona or envelope of the earth in a flash, it follows that life could thus be transmitted through space without trouble to the scientific mind.

Further than this, Prof. Roux, another French research student, put living spores in a vacuum—a jar freed of all oxygen and air—and kept these minute living things exposed for six months to ultra-violet light, and they were alive at the end of this time.

All of which goes to show that it is not beyond the bounds of reason, religion, or raving to maintain that life came to the earth through the travels of scurring "vitality" from world to world on the saddle of comets, cosmic dust, and meteors.

The Same Chemical Element May Have Different Atomic Weights

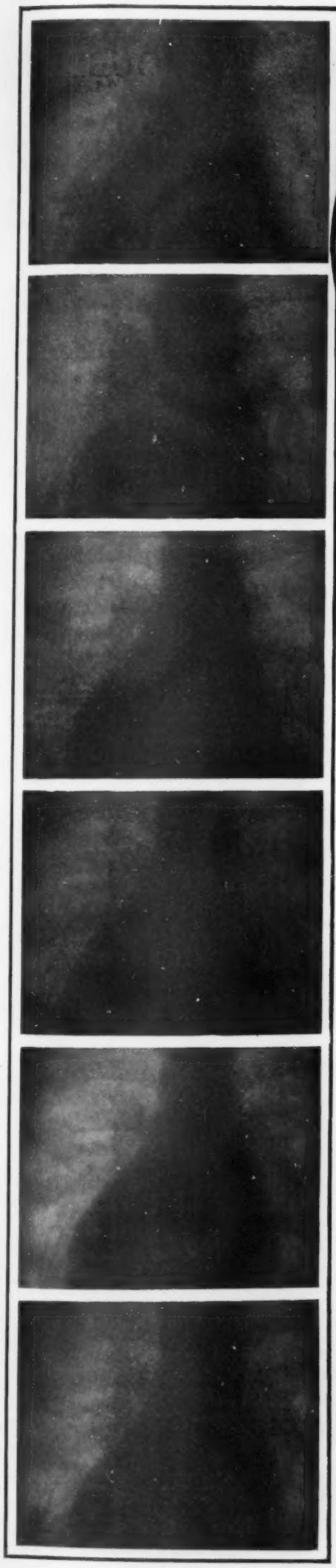
UNTIL recently it has been assumed that a given chemical element must always possess the same atomic weight, no matter from what mineral it is obtained. The inclusion of the radio-active elements in the periodic system, effected by Fajans and also by Soddy about a year ago, shows that we must assume the existence of elements which vary as much as 8 units in atomic weight, with corresponding variations in their radioactive properties (rays emitted, rate of decay, etc.), without any change in their chemical behavior. In reviewing the subject, *Umschau* observes that this conception was based on indirectly proved, or inferred, properties of the short-lived radioactive elements. Hence it was important to prove by direct experiment that two elements that appear chemically identical may have different atomic weights. The way to such an experimental demonstration was pointed out by Fajans, who concluded that the atomic weight of the lead formed in uranium ores, in the course of millions of years, as the final product of the disintegration of uranium, probably differs from the atomic weight of lead extracted from common lead ores.

This conclusion has now been confirmed experimentally by very careful determinations of the atomic weights of specimens of lead of diverse origins. The research was suggested by Fajans, and was carried out by his former assistant, Lembert, in the laboratory of Prof. Th. Richards in Harvard University, which is celebrated for its accurate methods of determining atomic weights. The atomic weight of lead obtained from uranium ores was found to be 206.6, while ordinary lead gave the distinctly different value 207.1.

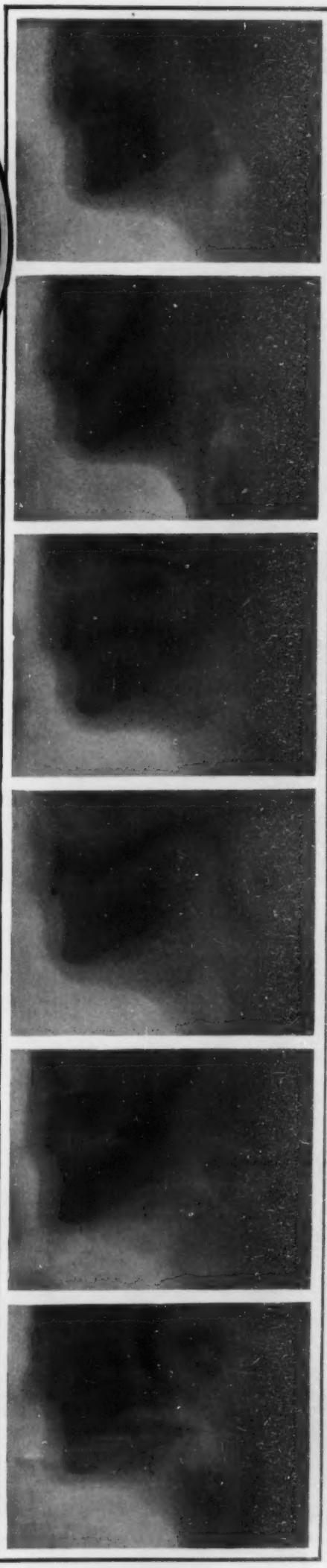
The uncertainty attaching to these results is less than 0.02, and is consequently very much smaller than the observed difference. It is notable that these two varieties of lead appear to be identical, spectroscopically as well as chemically.

Analogous considerations make it appear probable that the lead of thorium ores also differs in atomic weight from common lead, but is atomically heavier than the latter. Possibly common lead is a mixture of uranium and thorium lead.

The question naturally arises whether the observed atomic weights of most elements are not merely mean values of the atomic weights of several elements which are chemically identical, and consequently not separable by chemical methods. The study of atomic weights, therefore, is confronted with a wholly new task—the investigation of the atomic weights of elements as affected by their origin.



Six successive exposures made during one heart beat. Such X-ray snapshots are remarkable for their sharp outlines.



The act of swallowing analyzed by six successive exposures. Here we have the beginning of a new kind of motion picture photography.

LOCATION OF MOTORCYCLE POWER PLANT TROUBLES

A COMPLETE CHART OUTLINING THE COMMON DERANGEMENTS THAT INTERFERE WITH PROPER ACTION OF ENGINE AND AUXILIARY SYSTEMS

Chart Arranged by VICTOR W. PAGÉ, M. E., Author of "Motorcycles, Side Cars and Cyclecars," Etc.

MOTOR WILL NOT START OR STARTS HARD

a—Defects in Motor Mechanism.
- Seized Piston, or Dry Piston.
- Piston Rings Gummed to Cylinder.
- Valve Stuck (Automatic Inlet).
- Valve Gears Out of Time.
- Broken Connecting Rod or Crankpin (Rare).
- Broken Exhaust Valve Spring.
- Broken Inlet Valve Spring.
- Broken Valve Push Rod.

b—Fuel System Faults.
- No Gasoline in Tank.
- No Gasoline in Carburetor Float Chamber.
- Tank Shut-Off Closed.
- Clogged Filter Screen.
- Fuel Supply Pipe Clogged.
- Gasoline Level Too Low.
- Gasoline Level Too High (Flooding).
- Bent or Stuck Float Lever.
- Loose or Defective Inlet Manifold.
- Auxiliary Air Valve Spring Broken.
- Not Enough Gasoline at Jet.
- Punctured Metal Float (Causes Flooding).
- Fuel Soaked Cork Float (Causes Flooding).
- Water in Carburetor Spray Nozzle.
- Dirt in Float Chamber.
- Too Much Primary Air.
- Carburetor Frozen (Winter Only).

c—Ignition System Troubles.
- Loose Terminal.
- Magneto Ground Wire Shorted.
- Magneto Defective (No Spark at Plugs).
- Broken Spark Plug Insulation.
- Carbon Deposits or Oil Between Plug Points.
- Spark Plug Points Too Near Together or Far Apart.
- Wrong Cable to Plugs (Twin or 4 Cyl. Motors).
- Short Circuited Secondary Cable.
- Broken Secondary Cable.
- Battery Weak. (Battery Ignition System Only.)
- Poor Contact at Timer. (Battery Ignition System Only.)
- Timer Points Dirty. (Battery Ignition System Only.)
- Poor Contact at Switch. (Battery Ignition System Only.)
- Primary Wires Broken or Short Circuited. (Battery Ignition System Only.)
- Battery Grounded in Metal Container. (Battery Ignition System Only.)
- Battery Connectors Broken. (Battery Ignition System Only.)
- Timer Points Out of Adjustment. (Battery Ignition System Only.)
- Defects in Induction Coil. (Battery Ignition System Only.)
- Ignition Timing Wrong, Spark Too Late or Too Early.
- Defective Platinum Points in Breaker Box (Magneto).
- Points Not Separating.
- Broken Contact Maker Spring.
- No Contact at Secondary Collector Brush.
- Platinum Contact Points Burnt or Pitted.
- Contact Breaker Bell Crank Stuck.
- Fibre Bushing in Bell Crank Swollen.
- Short Circuiting Spring Always in Contact.
- Dirt or Water in Magneto Casing.
- Oil in Contact Breaker.
- Oil Soaked Brush and Collector Ring.
- Distributor Filled With Carbon Particles (4 Cylinder Magnetos).

MOTOR STOPS WITHOUT WARNING

- Broken Plug Wire (Single Cylinder).
- Broken Magneto Carbon Brush.
- Gasoline Shutoff Valve Jarred Closed.
- Gasoline Supply Pipe Clogged.
- No Gasoline in Tank.
- Spray Nozzle Stopped Up.
- Water in Spray Nozzle.
- Particle of Carbon Between Spark Plug Points.
- Magneto Short Circuited by Ground Wire.
- Air Lock in Gasoline Pipe.
- Broken Spark Plug Insulation.
- Inlet or Exhaust Valve Stuck Open.
- Piston Seized on Account of Defective Oiling.
- Bent or Broken Connecting Rod or Crankshaft (Rare).

INSTRUCTIONS FOR USE

In preparing this chart, the author assumes that all parts mentioned or illustrated in the sectional drawing of complete motorcycle power plant can be easily identified by the rider on the machine he operates. Obviously, there are many forms of power plants used, all of which differ only in points of minor detail. The arrangement of the parts in accompanying illustration is typical, and is intended only as a guide to make possible the ready location or identification of similar parts on standard machines. A single cylinder motor is shown for simplicity, though twin cylinder motors are the most common.

Motorcycle power plant troubles can be easily identified by readily recognized symptoms, and the same symptoms are often produced by widely differing causes. The defective conditions more apt to obtain are enumerated in tabular form. In most cases the method of repairing the defect is apparent. Those not understanding the motorcycle mechanism sufficiently to be able to use this condensed statement of common troubles or those who do not know how to repair the defects enumerated, will find the elementary text-book, "Motorcycles, Side Cars and Cyclecars,"* which the chart supplements (printed by the same publisher) of value in getting complete knowledge of motorcycle construction, maintenance, operation and repair. The novice should attempt to locate any trouble systematically and the logical enumeration of defective conditions should help him as well as the more expert.

For example, if the motor runs irregularly this condition is apparent at once. The points needing inspection are enumerated under that head, and if followed systematically the trouble can be found by elimination, even by the inexpert. The common troubles are all classed under easily recognized main symptoms, such as Lost Power, Noisy Operation, etc.

MOTOR STOPS WITHOUT WARNING.—*Continued*

- Broken Roller or Ball Bearing in Motor (Rare).
- Seized Main Bearings (Plain Bronze Bushings Only).
- Water on High Tension Magneto Terminal.
- Spark Plug Cable Burnt Through by Hot Exhaust Pipe.
- Insufficient Lubrication.
- Flywheels Wedged by Foreign Matter in Engine Base.
- Magneto Out of Time, Due to Slipping Drive.
- Sheared Key in Cams or Valve Operating Mechanism.
- Water or Oil in Safety Spark Gap (Four Cyl. Magneto).

MOTOR STOPS GRADUALLY

- Fuel Supply Pipe Partially Clogged.
- Air Vent in Tank Filler Cap Stopped Up.
- Float Needle Valve Stuck.
- Water or Dirt in Spray Nozzle.
- Mixture Adjusting Needle Jarred Loose.
- Air Valve Stuck Open.
- Loose Terminal at Plugs.
- Valves Stuck Open.
- Motor Overheating Due to Defective Oiling.
- Spark Advance Rod Broken.
- Throttle Rod Breaks.

MOTOR RACES

- Control Wires or Rods Broken.
- Auxiliary Air Valve Stuck Open.
- Defective Induction Pipe Joint.
- Leaky Valve Dome Packing.
- Throttle Not Closing.
- Magneto Contact Breaker Stuck in Advance Position.
- Clutch Slips (Chain or V Belt Drive).
- Belt Slips (Flat Belt Drive).
- Chain or Belt Broken.
- Sprocket or Pulley Driving Key Sheared Off.

MOTOR WILL NOT SPEED UP

- Auxiliary Air Valve Stuck Closed.
- Piston Binding in Cylinder.
- Not Enough Oil in Engine Base.
- Bent or Sticking Valve Stem.
- Too Much Play in Valve Operating Levers.
- Too Much Space Between Valve Stems and Push Rods.
- Valves Timed Late.
- Spark Timed Late.
- Throttle Stuck Closed.
- Magneto Contact Breaker Stuck in Retard Position.
- Worn Fibre Block in Magneto Contact Breaker.
- Binding Fibre Bushing in Contact Breaker Bell Crank.
- Dragging Brakes.
- Front or Rear Hub Bearings Too Tight.
- Wheel Bearings Broken.
- Driving System Parts Not in Alignment.
- Gear Ratio Too High.

MOTOR WILL NOT STOP

- Throttle Remains Open.
- Spark Interrupting Switch Out of Order.
- Incandescent Carbon Deposits Fire Charge.

MOTOR SPEEDS UP SUDDENLY

- Break in Chain or Belt.
- Clutch Slipping or Released.
- Chain Has Jumped Sprockets.
- Flat Belt Slipping.
- Throttle Has Jarred Open.

MOTOR RUNS IRREGULARLY OR MISFIRES

a—Defects in Motor Mechanism.
- Carbon Deposits in Combustion Chamber.
- Weak or Broken Valve Springs.
- Stuck Valve Stems.
- Carbon Under Valve Head.
- Worn Push Rod or Guide.
- No Clearance Between Valve Stem and Plungers.
- Air Leak in Inlet Piping.
- Broken Gasket Under Valve Dome.
- Air Leak Through Inlet Valve Guide (L Head).

b—Faults in Fuel Supply System.
- Carburetor Float Chamber Getting Dry.
- Water or Dirt in Gasoline.
- Air Valve Spring Weak or Broken.
- Poor Gasoline Adjustment.
- Poor Air Valve Adjustment.
- Not Enough Gasoline in Float Chamber.
- Too Much Gasoline, Carburetor Flooding.

c—Ignition System Faults.
- Loose Wiring or Terminals.
- Broken Spark Plug Insulator.
- Spark Plug Points Sooted or Oily.
- Wrong Spark Gap at Plug Points.
- Leaking Secondary Cable.
- Prematurely Grounded Primary Wire.
- Batteries Running Down (Battery Ignition Only).
- Poor Adjustment of Contact Points at Timer.
- Wire Broken Inside of Insulation.
- Loose Platinum Points in Magneto.
- Weak Contact Spring (Battery Timer Only).
- Broken Collector Brush.
- Dirt in Magneto Casing or Contact Breaker.
- Worn Fibre Block or Cam Plate in Magneto.
- Worn Cam in Timer (Battery System Only).

MOTOR NOISY IN ACTION

a—Mechanical Depreciation Producing Knocking.
- Foreign Matter in Engine, Such as Loose Nut in Engine Base.
- Carbon Deposits in Combustion Chamber.

MOTOR NOISY IN ACTION.—*Continued*

- Incandescent Spark Plug Points or Carbon Particles.
- Loose Wrist Pin Bearing.
- Loose Connecting Rod Big End Bearing.
- Worn Main Bearings.
- Piston Worn, Permitting Side Slap.
- Cylinder Worn Out of Round.
- Cylinder or Head Retention Nuts Loose.
- Play in Valve Operating Mechanism.
- Timing Gears Worn.
- Bent Crank Pin or Wrist Pin.
- Loose Flywheels.
- Loose Pulley or Sprocket.
- Poor Oil or Lack of Oil.
- Piston Rings Tight.

b—Mixture Troubles.
- Too Much Gasoline, Mixture Rich.
- Carburetor Float Chamber Flooding.

c—Ignition Trouble.
- Spark Timed Too Early.
- Magneto Contact Breaker Stuck Advanced.
- Magneto Loose on Engine Base.

d—Other Causes of Knocking.
- Engine Geared Too High.
- Overheating Due to Any Condition.

e—Hissing and Squeaking Sounds.
- Broken Insulation on Spark Plug.
- Spark Plug Leaks.
- Loose Joint Between Motor and Exhaust Pipe.
- Compression Relief Cock Jarred Open.
- Valve Dome Loose in Combustion Chamber.
- Valve Chamber Covers Loose (L and T Head Motors).
- Leaking Valve Cage Packing (Overhead Valve Motors).
- Poor Lubrication (Causes Squeaking).
- Muffler Leaking or Ruptured.
- Broken Piston Rings (Blowing Sound).
- Tight Piston Rings (Scraping Sound).

f—Popping or Blowing Back in Carburetor.
- Incorrectly Timed Inlet Valve.
- Inlet Valve Not Seating.
- Defective Inlet Valve Spring.
- Dirt Under Inlet Valve Seat.
- Defective Auxiliary Air Valve (Admits Too Much Air).
- Not Enough Gasoline (Open Needle Valve).
- Spark Retarded Too Much.
- Contact Points in Breaker Box or Timer Pitted.
- Weak Batteries (Battery Models Only).
- Wrong Cables to Plugs (2 Cyl. and 4 Cyl. Motors).

g—Muffler Explosions.
- Mixture Not Exploding Regularly.
- Exhaust Valve Sticking.
- Dirt Under Exhaust Valve Seat.
- Wrong Cables to Plugs (2 Cyl. and 4 Cyl. Motors).

h—Grinding Noises.
- Worn Timing Gears.
- Defective Cylinder Lubrication.
- Worn Driving Chains.
- Worn Two-Speed Gearing.

MOTOR LOSES POWER

a—Causes of Poor Compression.
- Loose Spark Plug.
- Defective Cylinder Head Gasket.
- Cracked Piston or Cylinder.
- Leaky Valves (Regrind).
- Warped Valve Heads.
- Piston Ring Joints in Line.
- Inlet Valve Dome Loose on Cylinder.

b—Other Causes of Lost Power.
- Exhaust Valve Lift Insufficient.
- Inlet Valve Lift Insufficient.
- Choked Muffler.
- Carbon Deposits.
- Tight Bearings.
- Cylinder Dry or Overheated.
- Oil Too Light.
- Oil Too Heavy.
- Oil Carbonizes at Too Low Temperature.
- Overheating Due to Driving With Retarded Spark.
- Overheating Due to Racing Motor on Low Speed Gear.
- Overheating Due to Too Rich Mixture.
- Oil Feed Interrupted.
- Defective Oil Pump.

Note.—All causes contributing to irregular motor action also produce lost power.

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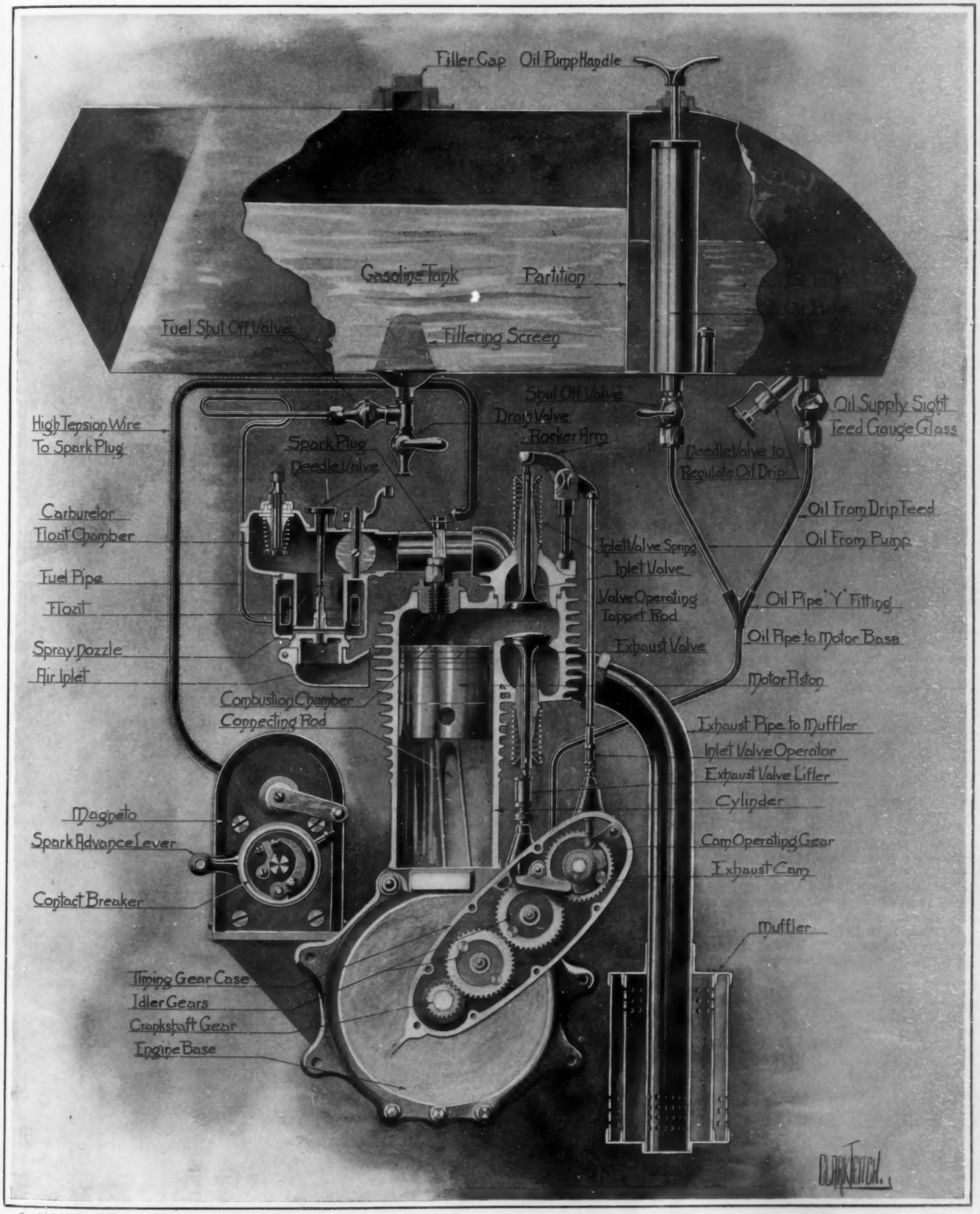
A TYPICAL SINGLE-CYLINDER ENGINE OF A MOTORCYCLE

TWIN CYLINDER MOTORS ARE THE MOST COMMON, BUT A SINGLE-CYLINDER IS SHOWN FOR THE SAKE OF SIMPLICITY



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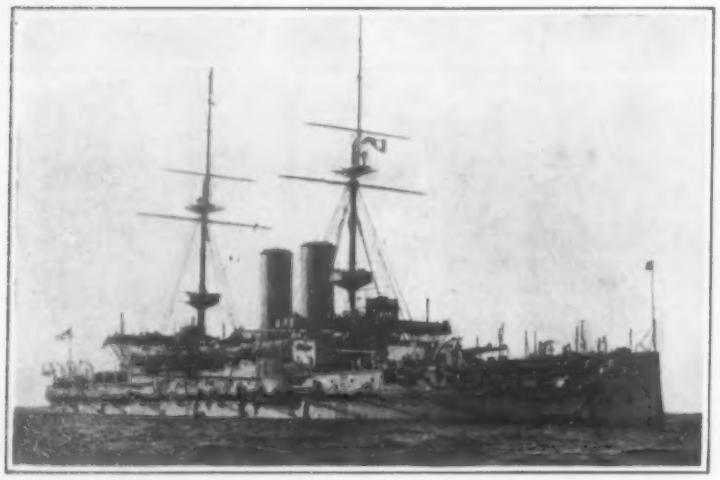
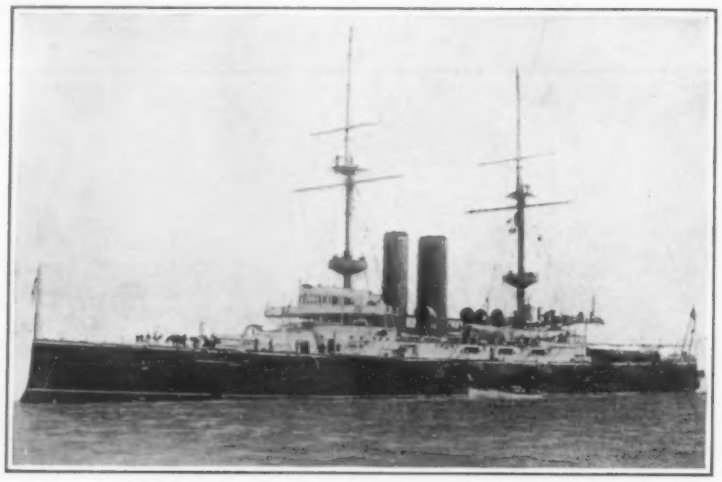
Forcing the Dardanelles

Floating Mines and Gunfire Work Havoc on the Allied Fleet



British battleship "Irresistible," sunk in the Dardanelles.



British battleship "Ocean," sunk in the Dardanelles.

THE certainty of heavy losses when a fleet engages strong shore batteries, particularly if, as in the case of the Dardanelles, it is necessary to come within effective range of the guns and operate in confined waters where maneuvering is difficult, was proved in the engagement which took place between the allied French and British fleets on the 18th of March.

In our last description of the Dardanelles and the operations to take the forts, we outlined the methods by which the reduction of the latter is being attempted, namely, by indirect fire across the Gallipoli Peninsula, assisted by observation from ships properly stationed for the purpose, and by direct fire from ships within the straits after the forts guarding the entrance had been reduced.

When the fire of the 15-inch guns of the "Queen Elizabeth" had silenced the guns of the most heavily armed forts at the Narrows and the shore batteries had also been silenced by the direct fire of ships that had entered the straits, heavy mine-sweeping operations were carried on, much of it under heavy fire from the enemy, with a view to clearing the way for the approach of the fleet, for reducing, in detail, the heavy forts on both sides of the Narrows.

The Admiralty statement covering the great battle of the 18th of March is as follows:

"Mine-sweeping having been in progress during the last ten days inside the straits, a general attack was delivered by the British and French fleets yesterday (Thursday) morning upon the fortresses at the Narrows.

"At 10:45 A. M. the 'Queen Elizabeth,' 'Inflexible,' 'Agamemnon,' and 'Lord Nelson' bombarded Forts J, L, T, U, and C, while the 'Triumph' and 'Prince George' fired at Batteries F, E, and H. A heavy fire was opened on the ships from the howitzers and field guns.

"At 12:22 o'clock the French squadron, consisting of the 'Suffren,' 'Gaulois,' 'Charlemagne,' and 'Bouvet,' advanced up the Dardanelles and engaged the forts at closer range. Forts J, U, F, and E replied strongly. Their fire was silenced by the ten battleships inside the straits, all the ships being hit several times during this part of the action.

"By 1:25 P. M. all the forts had ceased firing. The 'Vengeance,' 'Irresistible,' 'Albion,' 'Ocean,' 'Swiftsure,' and 'Majestic' then advanced to relieve the six old battleships inside the straits.

"Bouvet" Sunk, then Two British.

"As the French squadron, which had engaged the forts in a most brilliant fashion, was passing out the 'Bouvet' was blown up by a drifting mine. She sank in 36 fathoms north of Erenkeui village in less than three minutes.

"At 2:36 P. M. the relief battleships renewed the attack on the forts, which again opened fire. The attack on the forts was maintained while the operations of the mine sweepers continued.

"At 4:09 P. M. the 'Irresistible' quitted the line, listing heavily, and at 5:50 o'clock sank, having probably struck a drifting mine. At 6:05 o'clock the 'Ocean,' also having struck a mine, sank.

"Both vessels sank in deep water, practically the whole of their crews having been removed safely under a hot fire.

"The 'Gaulois' was damaged by gunfire. The 'Inflexible' had the forward control position hit by a heavy shell and required repair.

"The bombardment of the forts and the mine-sweeping operations terminated when darkness fell. The damage to the forts, effected by the prolonged direct fire of the very powerful forces employed, cannot yet be estimated, and a further report will follow.

Mines Brought by Current.

"The losses of the ships was caused by mines drifting with the current which were encountered in areas hitherto swept clear, and this danger will require special treatment.

"The British casualties in the *personnel* were not heavy, considering the scale of the operations, but practically the whole of the crew of the 'Bouvet' were lost with the ship, an internal explosion having apparently supervened on the explosion of the mine.

"The 'Queen' and the 'Implacable,' which have been dispatched from England to replace the ships' casualties, in anticipation of this operation, are due to arrive immediately, thus bringing the British fleet up to its original strength. The operations are continuing with the naval and military forces available on the spot.

Admiral De Robeck Now Commands.

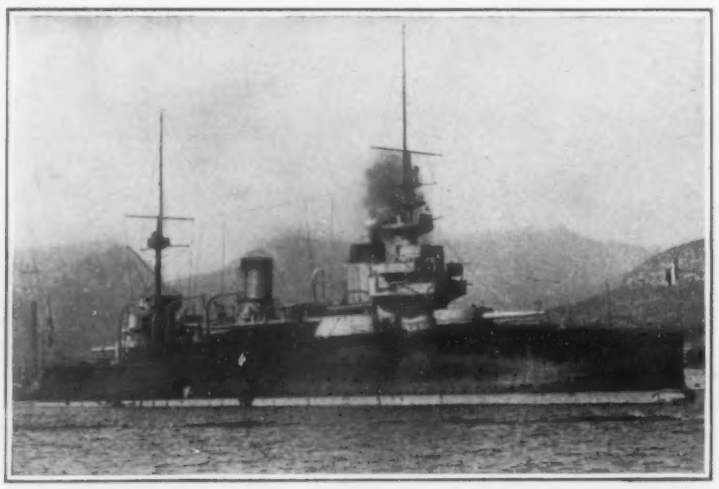
"On the 16th instant, Vice Admiral Carden, who had been incapacitated by illness, was succeeded in the chief command by Rear Admiral John Michael de Robeck, with the acting rank of Vice Admiral."

Subsequent observation by aeroplanes flying at a low altitude proved that the tremendous bombardment by the fleet had been very effective, some of the forts being described as being knocked entirely to pieces. On the other hand, it must be admitted that the fleet paid a heavy toll for its daring to attempt the supposedly impossible. The British lost three battleships and the French one, while the battle-cruiser "Inflexible" and the battleship "Gaulois" were damaged by shells from the Turkish forts. The four battleships which went down were all old vessels, the "Irresistible" having been completed in 1902, the "Ocean" in 1900, and the French "Bouvet" in 1896. The flagship "Inflexible," a battle-cruiser completed in 1908, was struck by a heavy shell in the forward control station, and the old French battleship "Gaulois," completed in 1895, was also badly damaged, both this ship and the "Inflexible" being put out of action until repairs can be effected.

The loss of these ships was due to the setting afloat by the Turks of a large number of floating mines, which, carried down through the straits by a current which, at certain states of the tide, runs sometimes as fast as five knots, are a constant menace to the attacking fleet. These mines are not to be confused with those which are anchored and are removed by mine-sweeping. Against the floating mines the only defense is carefully to watch for them, and, when they are detected, destroy them at once by shell fire, or else tow them by small boats to the side of the channel out of the way of the ships.

The claim of the Allies that they have inflicted heavy damage on the forts is flatly contradicted by dispatches from Turkish and German quarters in Constantinople. These state that the fire of the fleet, powerful and long-continued though it was, failed to do any serious damage to the batteries. The claim is made that the shells exploded, for the most part, harmlessly in the earthworks, and that much of the fire, because of the smoke and dust, was inaccurate. One interesting development has been the re-enforcement of the defenses by field guns and howitzers, mounted on shore railways.

Battle-cruiser "Inflexible," disabled in the Dardanelles attack.



French battleship "Bouvet," sunk in the Dardanelles.

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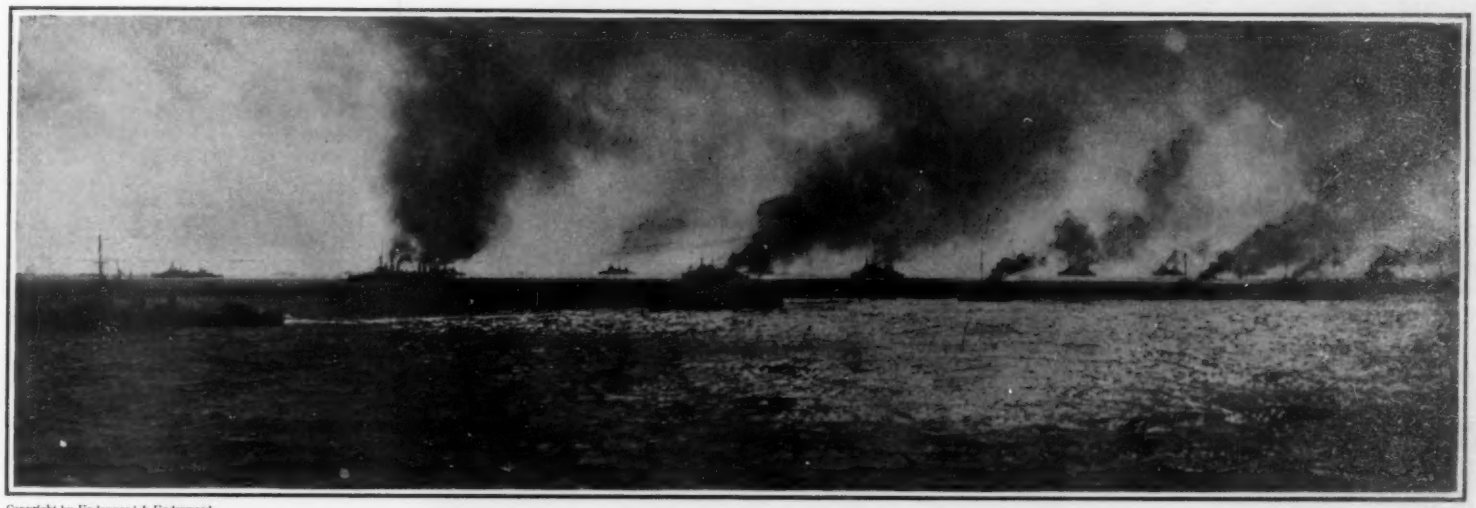
A panoramic view of Constantinople, the objective of the fleets now engaged in the Dardanelles.



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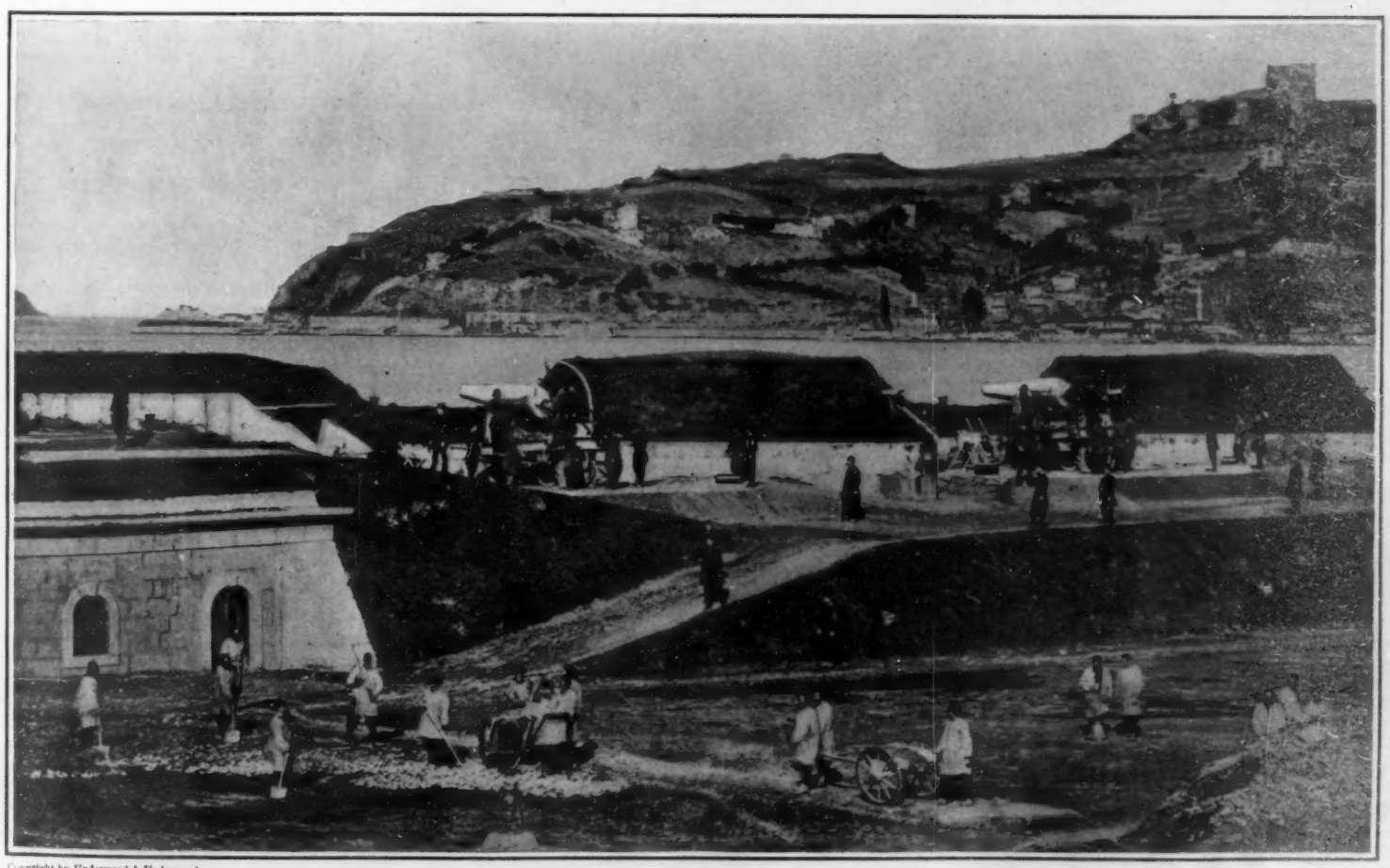
The Allied fleet operating against the Dardanelles. Photograph taken from the French battleship "Bouvet."



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An obsolete battery in one of the older Dardanelles forts.

The Heavens in April

Nebulæ; Their Nature, Dimensions and Distances from Us

By Henry Norris Russell, Ph.D.

AMONG the most difficult of the yet unsolved problems of astronomy is that of the distances, dimensions, and nature of the nebulæ. Thousands of these hazy patches of light are visible with telescopes of no exceptional power, and the number which could be photographed with great telescopes, if time was available, to take the whole heavens with long exposures, must be fully 150,000, as was told in these columns a year ago.

It has been known since the dawn of spectroscopic investigation that the nebulæ, when studied by this powerful method of research, fall sharply into two classes—the "green nebulæ" (as Prof. Young called them), whose spectrum shows that their light comes almost entirely from rarefied gases, and the "white nebulæ," which for many years refused to yield any clear evidence of their nature to the visual observations of even the keenest observers.

Half a dozen years ago photography solved the riddle by showing that spectra of these white nebulæ were essentially similar to that of the Sun or of other stars. This left two theories of their nature open; either they were single stars, enveloped in a dense fog of some sort which concealed the central body but reflected its light, or they were vast clusters of stars, too remote, too faint, and too close together in the sky to be seen separately, even in great telescopes, just as the star clouds in the Milky Way look to the naked eye like continuous masses of light.

But, though we have thus known for some time a little of the probable constitution of the nebulæ, we have been, till within little more than a year or so, utterly in the dark concerning their distances and real dimensions. Since they are practically fixed in the heavens, showing far less "proper motion" than the nearer stars, we could be fairly sure that they were farther off than these, our nearest cosmic neighbors, but beyond this there was little to say.

Toward the close of 1913, however, Dr. Slipher of the Lowell Observatory announced that he had secured spectrograms of the Great Nebula in Andromeda, which showed that it was approaching us at the unprecedentedly great radial velocity of 300 kilometers per second, and in a later communication, recently published, he reports measures on other white nebulæ, of spiral form, which are even more remarkable. One nebula in Virgo is receding at the tremendous rate of 1,100 kilometers, or nearly 700 miles, per second, and the average velocity, in the line of sight, of the fifteen objects so far observed, is fully 400 kilometers per second, which is about twenty-five times the average rate of motion of the thousand or more individual stars which have been observed spectroscopically in similar fashion.

Other observers have confirmed Slipher's results regarding the motion of the Andromeda nebula, and there remains no doubt that these great luminous clouds are in motion far more rapidly than any other known bodies.

Still more recently, Prof. Campbell has summarized the results of similar observations made at the Lick Observatory on a number of gaseous nebulæ, mostly of the small and sharply defined sort which from their appearance are called "planetary." These are also in rapid motion, their velocities in the line of sight averaging nearly 50 kilometers per second, which is three times the average for the stars, though far less than for the spiral nebulæ.

We are now in a position, if not to determine the average distances of these nebulæ, at least to extend our estimate of their minimum average distance to a very marked degree. There is not one nebula in the sky whose apparent proper motion in the heavens is as rapid as one tenth of a second of arc per year, though one out of four of the stars visible to the naked eye exceeds this limit. Indeed, the apparent motions of the nebulæ are so slow, and they are usually such ill-defined objects to set upon, that it is usually impossible to say whether they are moving at all. Recent studies, both photographic and visual, make it clear that the average apparent motion of these objects cannot be greater than one twentieth of a second of arc annually, and is probably much less. But the actual velocities of the nebular motions which appear to us in the sky to be so slow are probably as great as those revealed by the spectroscope; indeed, they should average greater, for it is easy to show that, in the case of a large number of bodies moving at random in all directions, there is a greater chance that the motion will be mainly at right angles to our line of sight than that it will be directed straight toward or from us.

In this way we may estimate that the actual motion of a gaseous planetary nebula in the sky corresponds to an annual shift of fully fifteen times the distance of the Earth from the Sun, and that of a white spiral nebula to no less than 120 of these astronomical units.

Even with the exaggerated estimate of the nebular proper motions made above, this would indicate that the planetary nebulæ were, on the average, at least 1,000 light-years distant, and the spiral nebulæ eight times as remote. But these are minimum limits, and probably much too small. It would seem more accordant with the data available at the moment to say that the average distance of the planetary nebulæ is probably at least two or three thousand light-years, and that of the spiral nebulæ twenty thousand or more; and it seems probable that fuller knowledge is fully as likely to increase as to diminish these figures.

The dimensions which the nebulæ must have, to appear as big as they do at such distances, are astounding. Even the planetary nebulæ, at the smallest estimate of their distances, must be hundreds of times the diameter of our whole solar system, and the size of the spirals can only be measurable in light-years, perhaps in tens or even hundreds of them.

This disposes altogether of the idea that they can be masses of cosmic fog, lit up by single stars, and leaves us shut up to the belief that they are star-clusters.

A further support to this theory is afforded by the latest observations of all, announced but a few days ago.

The Magellanic Clouds, those curious outlying patches of light in the southern heavens to which we referred last month, contain, in addition to innumerable faint stars, many nebulæ, which from their positions and grouping seem almost certainly to be themselves a part of the clouds. Prof. Wilson, measuring the radial velocities of these nebulæ from Lick Observatory photographs, finds that four of them, in the larger of the two clouds, have very large and nearly equal velocities of recession, averaging 275 kilometers per second—far greater than that of any other gaseous nebulæ so far observed—while one in the smaller cloud is also receding, but at 160 kilometers a second.

This suggests very strongly that these great clouds of stars and nebulæ are themselves in motion at these velocities. If observations of the individual stars in the clouds prove practicable and show that they are moving at a similar rate, there will be very good reason for thinking that the white nebulæ, which show just the same spectrum which the star-clouds would exhibit, and are moving with comparable velocities, are really of the same nature, but too far off to be "resolved" telescopically. This brings us back to the old conception, held two generations ago, but almost abandoned, that the nebulæ are other "universes" of stars like our own.

Hutzsprung's estimate that the smaller Magellanic Cloud is 30,000 light-years distant gives us some idea how far away this hypothesis would put the irresolvable spirals. It is doubtful whether light itself could traverse such stupendous distances without serious losses; but there is no demonstrative evidence that such is the case, and it well may be that we are on the brink of an expansion of our conception of the extent of the universe almost comparable to that which resulted from the first measurements of the distances of the nearer stars.

At 11 o'clock: Apr. 7.
At 10½ o'clock: Apr. 14.
At 10 o'clock: Apr. 22.

At 9 o'clock: May 7.
At 8½ o'clock: May 15.
At 8 o'clock: May 22.

At 9½ o'clock: April 30.

NIGHT SKY: APRIL AND MAY

The Heavens.

If one holds the accompanying map right over his head, he will see the heavens as they would appear to a man lying on his back and looking upward. The Great Bear is nearly overhead, extending to the northward. The curving line of its tail, the handle of the "Dipper," points toward Arcturus, the principal star of Boötes, and the brightest now visible.

Below, and farther to the west, is the white star Spica, in Virgo; and in the southwest is Regulus, in Leo. The twin stars Castor and Pollux, in Gemini, are conspicuous in the west, with Procyon on the left and Capella on the right, well down in the northwest. The bright object, not shown on the map, below Castor and Pollux, is the planet Saturn.

Below the pole we see the zigzag line of Cassiopeia, and in the northeast, still near the horizon, is the great white star Vega.

With these as sky-marks, it will take only a few moments' study for even the novice to complete his acquaintance with the visible constellations.

The Planets.

Mercury is a morning star all through April, but is on the far side of the Sun, and gets more and more nearly in line behind him, so that he is hard to see, even at the beginning of the month, when he rises about 5 A. M., and is invisible by the 15th.

Venus is also a morning star, in Aquarius and Pisces, rising at 4:20 A. M. on the 1st, and 3:50 on the 30th, as she comes farther north during the month. She seems still about six times as bright as Sirius, though she has lost fully half her light since the first of January.

On the morning of the 15th she passes very close to Jupiter, the nearest approach, which occurs after sunrise in the United States, being within 9 minutes of arc. These two planets, the brightest in the sky, will, however, appear on this morning to be distant from one another by less than the Moon's diameter, and the sight will be well worth rising to look at.

Mars is a morning star, too, near the others in the sky, and rises at 4:20 A. M. on the 15th. On the 3rd he is in conjunction with Mercury, being 1½ degrees north of him. Mercury will appear five or six times brighter than Mars, but the sky will be so bright by the time they have fairly risen that it will be hard to see them at all.

Jupiter again is a morning star, rising about 4 A. M., and fairly well observable before daybreak.

Saturn is evening star, between Taurus and Gemini, and remains in sight till 11:30 P. M. in the middle of the month.

Uranus is in Capricornus and rises between 2 and 3 A. M. Neptune is in the very opposite quarter of the sky, in Gemini, and is in quadrature with the Sun on the 18th, when he crosses the meridian at 6 P. M., but on account of his high northern declination, does not set till after 1 A. M.

The Moon is in her last quarter at 3 P. M. on the 6th, new at 7 A. M. on the 14th, in her last quarter at 11 A. M. on the 22nd, and full at 9 A. M. on the 29th. She is nearest us on the 1st and 30th, and farthest

(Concluded on page 325.)

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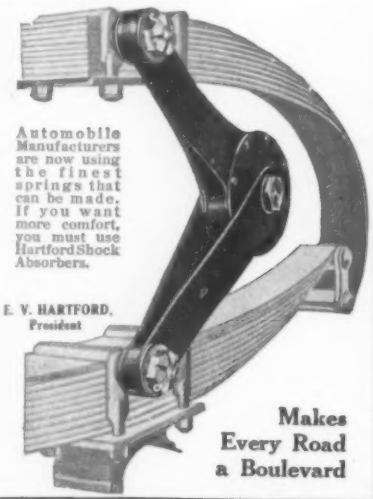

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Legal Notes

"Means" and "Mechanism."—The U. S. Circuit Court of Appeals for the Sixth Circuit in Davis Sewing Machine Company v. New Departure Manufacturing Company, has held that a claim of a patent is not functional and invalid merely because one of its specified elements is "means" or "mechanism," this depending upon whether such term is used with reference to the element or sub-combination which is the real point and gist of the invention, or to elements or parts already known and designed to co-operate with the new element in order to complete the claim.

An Application for Patent Cannot be Enjoined.—In a recent case in which it was sought to enjoin the filing of an application for patent, Chief Justice Shepherd of the District of Columbia Court of Appeals in affirming the decision of the District Supreme Court decided that the court had no jurisdiction in such cases as the Patent Office procedure is sufficient to determine the real inventorship, with the usual appeals on such question.

Supreme Court Decisions as to Profits.—The Supreme Court of the United States decided by Mr. Justice Van Devanter in Dowagiac Manufacturing Company v. Minnesota Moline Plow Company et al., Dowagiac Manufacturing Company v. Smith and Zimmer, has held that where a patent is infringed by the sale of machines which include improvements covered by the patent and the value of the machines is attributable in part to the patented features and in part to unpatented features, the profits arising from the infringing sales belong to the owner of the patent in so far as they are attributable to the patented improvements, and belong to the seller in so far as they are due to the other parts or features.

A Complex Interference Case.—In the Court of Appeals of the District of Columbia, Justice Van Orsdel in Wilson v. Harris v. Ellis in a paint removing case involved in interference held that where the application discloses two compositions, one containing wax but not benzol and the other benzol but not wax, such application does not disclose the use of both benzol and wax in the same composition, and while it was argued that to add benzol or wax did not constitute invention, such question was not before the court.

Trade-mark Notes

Trade-mark Similarity.—In Underwood Typewriter Company v. The Universal Stenotype Company, the Commissioner of Patents in reversing the decision of the Examiner of Interferences which sustained a demurrer by the Stenotype Company to the oppositi n of he Underwood Company, held that the U. and T. in the Stenotype Company's mark res mbled the form of such letters as us d in the Underwood Company's monogram mark T. U. S. and that the difference does not sufficiently distinguish the marks to avoid confusion. A number of cases are cited in the decision including the Summit City Soap Works v. the Standard Soap Company, in which the Court of Appeals for the District of Columbia said:

"This court has adopted a strict rule in refusing registration in all cases where the apparent similarity would probably lead to confusion in trade, holding that the field of selection for marks is so broad that no necessity exists for the invasion of one trader upon even the apparent rights of another and that the broadest protection will be afforded the purchasing, consuming public by the courts."

Trade-Mark Registrations in South America.—The importance of trade-mark registration in South American countries has been repeatedly emphasized in these columns. It has never before had the importance it has to-day. Director Barrett of the Pan-American Union is reported as asserting that South America is a purchaser annually of nearly $700,000,000 worth of manufactured products from Europe. He urges that American manufacturers and financiers make an effort at this time to meet the demand, predicting that a magnanimous treatment of the South American countries in the predicament resulting from the European wars and cutting off of supplies from such quarter should operate to our trade advantage throughout the future.

Notes for Inventors

Why Not Button It On?—A woman makes this suggestion. She asks: Why cannot the shoe covers or "spats" be secured to the low shoes on which they are commonly used by snap buttons like glove fasteners? The problem will be so to locate the buttons as to exclude them from view when the shoes are used without the "spats" and also to secure such arrangement as will not be uncomfortable to the wearer.

No Safety Now.—Safety razor blades will never be safe now that the women folks can use them for ripping. A patent, No. 1,129,681, has been issued to Guy L. Huyett of Minneapolis, Kansas, for a ripping device in which a safety razor blade is held in a flanged holder so formed as to protect the cutting edges except at one side of one end which is exposed for use in ripping.

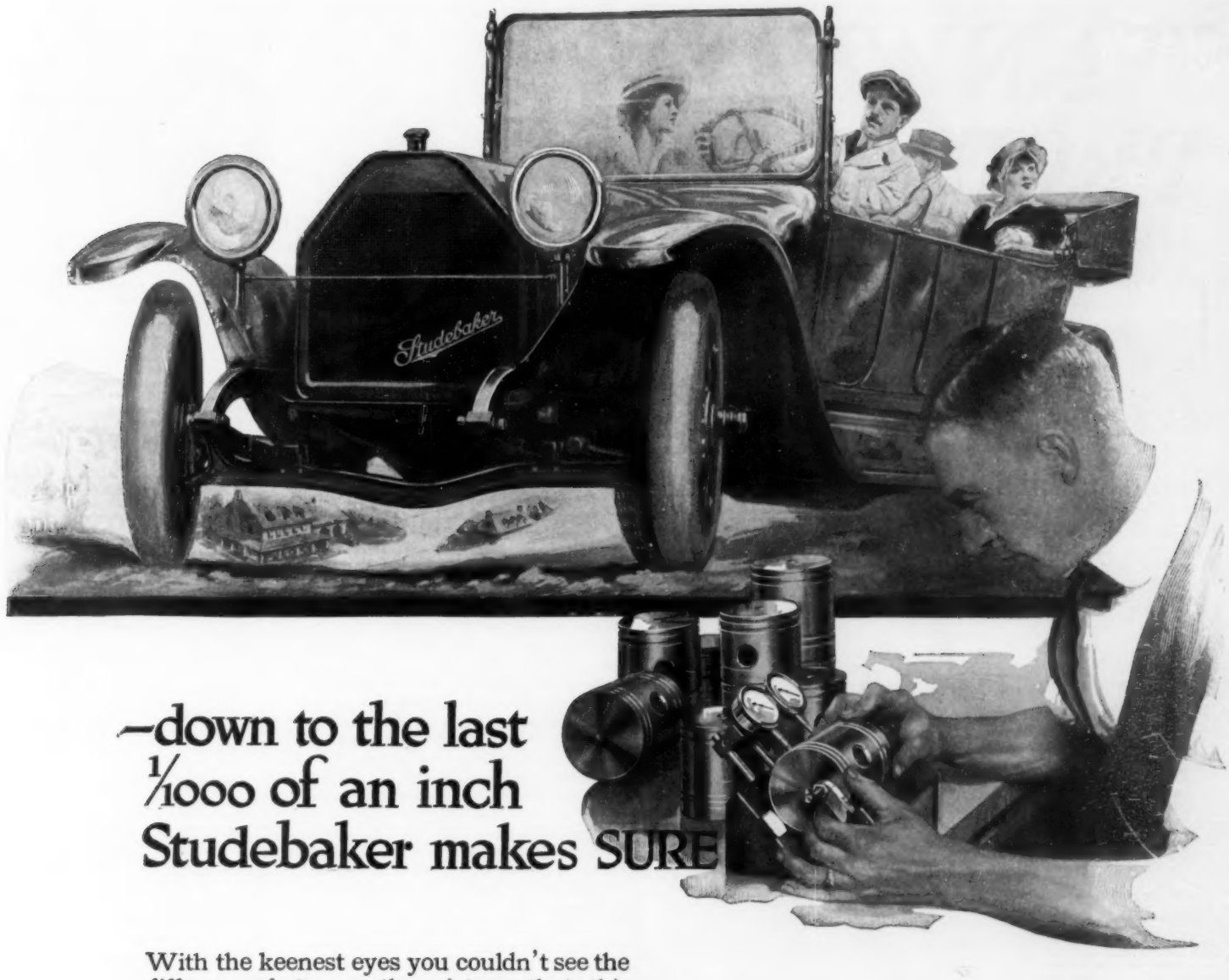
Roughening the Tongue Side of Dental Plate.—George A. Critcherson, of Los Angeles, Cal., claiming that dental plates molded with a smooth lingual side result in imperfect articulation of speech and imperfect management of food in mastication, has in patents Nos. 1,129,335 and 1,129,336 provided a dental plate and mold therefor by which the plate is formed on the side next to the tongue in the similitude of the natural human mouth in order to overcome the objections referred to above.

This Dairyman Collects His "Empties."—The failure of consumers to return empty milk bottles is a frequent cause of complaint by the milkman and is a source of expense which the consumer must ultimately pay. D. H. Buckley, of Vienna, Ohio, in a patent, No. 1,129,068, has sought to overcome this by a bottle locker operated without special keys which consume time in manipulation, and in which it is impossible to remove a filled bottle without first placing an empty one in the proper compartment of the device, thereby operating as a check upon bottles to be returned and forcing the customer to put an empty in the locker before the bottle of milk can be removed for use.

Damage by Metallurgical Smoke.—Suits have originated in many States, including Utah, Tennessee, Montana, and California because of damages claimed to have resulted from the fumes from smelters commonly referred to as smelter-smoke. Various processes of overcoming or decreasing the evil have been devised, including absorption in water, refrigeration, the use of finely ground slag or slag wool, dilution of the sulphur dioxide by air, as well as bringing the gases containing sulphur dioxide into intimate contact with lime in the presence of water. Considerable friction is still caused by smelter-smoke between the metallurgical and agricultural industries in certain parts of the country, which indicates the opportunity of high-class technical invention directed to the subject. A few years ago a committee consisting of Dr. Holmes, director of the Federal Bureau of Mines, E. C. Franklin of Stanford University and Ralph A. Gould, a chemical engineer of San Francisco, was appointed to investigate and decide future questions of annoyance and nuisance resulting from the escape of smelter-fumes and its report, submitted November, 1914, is to be published as soon as practicable.

The Death of Ross S. Turner.—Ross S. Turner the well-known artist and art instructor of Boston, died recently in the Bahama Islands. Early in his career he was a draftsman in the United States Patent Office at Washington.

Why Not a Collapsible Cigar Case?—It may not be new, but the writer has never seen it in use or for sale; that is to say, a compartment cigar case to put in the pocket whose unfilled compartment or compartments may be collapsed without impairing the protection offered to the cigar or cigars contained in the filled compartment. Possibly some inventor can produce such a case.



—down to the last 1/1000 of an inch Studebaker makes SURE

With the keenest eyes you couldn't see the difference between the pistons that this man accepts and those that he rejects because they measure one-thousandth of one inch more or less than the Studebaker design calls for.

And yet that little difference of one-thousandth of one inch is so important to Studebaker that not only are hundreds of the most attentive and skillful inspectors kept busy every minute of the day making just such minute inspections—but the whole manufacturing organization is keyed up to that "thousandth-inch" ideal of manufacture.

For "—because it's a Stubebaker"—because this car carries a name that for more than 63 years has stood for the highest achievements in manufacturing, a name that represents millions of dollars invested and millions of friends in every country on the globe, Studebaker MAKES SURE down to the last one-thousandth of the inch.

And this piston test is only typical. For this insistence on accuracy to the thousandth of the inch applies to every little detail of the car—the gears, crankshafts, camshafts, even to the bolt-holes in the fly-wheels.

For it is only in this way—by manufacturing Studebaker cars COMPLETE in Studebaker plants, and manufacturing them to this "thousandth-inch" ideal, that Studebaker can be SURE of getting the quality, the CERTAINTY, the harmony of operation that a man EXPECTS in this car

—because it's a

Studebaker

But you can only begin to appreciate fully what this Studebaker accuracy means when you ride in the

LIGHT SIX—$1385

and KNOW from your own experience on the roads the silence, the riding comfort, the ease of driving and the smooth running qualities that Studebaker has built into it. And when you study the balance, the alignment of the chassis, and how the Studebaker engineers, cutting down the weight of the car, also cut down its upkeep cost, you will appreciate what it means to buy a car built in the Studebaker way to live up to Studebaker ideals of giving the buyer FULL money's worth for every dollar of the price. See this SIX—and ride in it—drive it yourself. Your local Studebaker dealer will be delighted to put it thro' its paces for you—anytime you say. And if you will write us, we will mail you "The Story of Studebaker"—a handsomely illustrated book of 72 pages telling in detail how Studebaker lives up to the meaning of its name.

STUDEBAKER—DETROIT, Canadian Plants, Walkerville, Ont.

Studebaker Features

Electric Lighting and Starting—Full Floating Rear Axle—Timken Bearings—Safety Tread Rear Tires—One-man Type Top.

	Price in U. S. A.	Price in Canada
Studebaker ROADSTER, . .	$985	$1250
Studebaker FOUR, ...	985	1250
Studebaker LIGHT SIX, . .	1385	1750
Studebaker SIX (7-passenger),	1450	1825

F. O. B. Detroit

STANWELD PRODUCTS

Tire-Bases and Bands for Motor Trucks

TO BUYERS of steel bands for motor truck wheels and steel bases for solid tires, we offer the largest and quickest source of supply in the world. In the production of this class of wheel-equipment our facilities are practically unlimited.

We have in stock at all times upwards of 10,000 tons of steel for the manufacture of tire-bases and wheel-bands, and are able to fabricate this material into finished product at remarkable speed.

Quantity, thickness or diameter of material, time of delivery, quality, and tolerances are items that we have no difficulty in conforming to. Our facilities are complete, and we can produce material in American or Millimeter sizes with equal rapidity and accuracy.

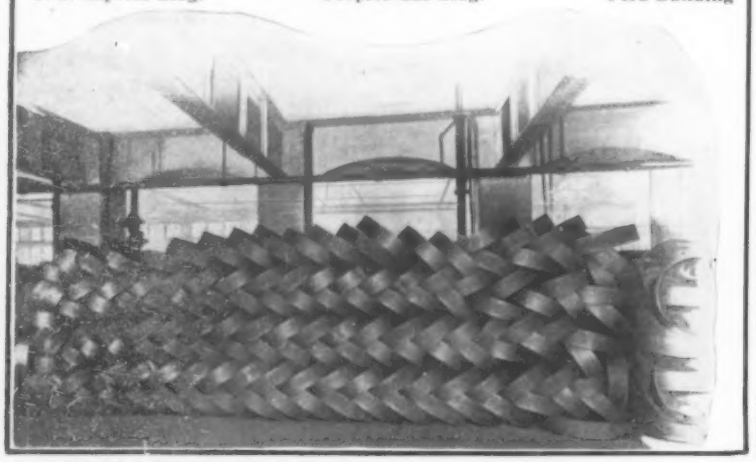
Prompt attention given correspondence.

The Standard Welding Company

Pioneers and World's Largest Producers of Rims for Motor Driven Vehicles

Main Office and Factory, Cleveland, Ohio, U. S. A.

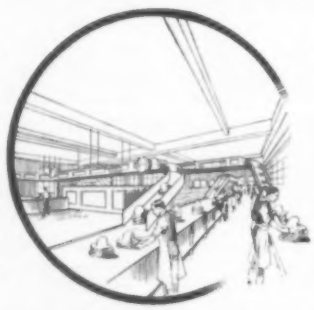
New York, U. S. Express Bldg. Chicago, Peoples Gas Bldg. Detroit, Ford Building



Unfailing Delivery of Raw Material and Parts to Workmen in a Modern Factory

THIS is a problem for the factory cost man.

If every workman is promptly supplied with materials, he is of more value to the firm and to himself.



If he is supplied by a mechanical carrier that delivers as well as carries away, that never idles, is never tardy, never makes mistakes, never stops—the saving in time and increase in amount of work is appreciable.

Multiply this by the number of hands supplied and you see a big opportunity to save on production costs.

There is hardly a factory or industrial plant of any size anywhere that cannot profitably use a Lamson Conveying System of some kind. Thousands of manufacturers, including many of the largest in the United States, have installed Lamson Systems and found them extremely profitable.

A Lamson System pays for itself quickly in wages saved alone, at the same time adding to the greater efficiency of the working force.

And increased efficiency is everywhere reflected in offices, banks, hotels, libraries and three hundred other kinds of business where Lamson Carriers and Conveyors are used.

How may a carrying system be devised and installed to meet your particular requirements? This is a question answered by Lamson Service. Our engineers will study your problem, submit charts and cost—all without involving the slightest obligation.

A request on your letterhead or the coupon below will receive prompt attention—also bring an interesting story, entitled "New Wings for Business."

LAMSON SERVICE

THE WING'S (5) *of BUSINESS*

How Lamson Service works for the John B. Stetson Hat Factory, in Philadelphia

In this great industrial plant, three Lamson Systems are in service. A carrier pick-up system distributes mail and papers throughout all the offices and departments. In the factory a system of belt conveyors carries sweat band leathers, unfinished hats and other materials from one group of workmen to another. Still another system of heavy chain conveyors carries filled packing boxes to stock and shipping rooms, taking them from one building to another and up five floors in an endless stream, without human aid. Descriptive booklet of Lamson Service in Stetson plant sent upon request.

Architects and Engineers will find complete reference to Lamson Service in Sweet's Index and Cond. Cat. A.S.M.E.

THE LAMSON COMPANY, 161 Devonshire Street, Boston, Mass.

Will you please tell me if Lamson Service can serve me economically and how (Write name, address and character of business below.)

The Decision in the United Shoe Machinery Case

THE decision of the Court in the United Shoe Machinery case, in an opinion written by Judge Putnam, than whom there is no better patent lawyer on the Federal Bench, holds that the company under its patents had the right to impose such conditions as it deemed advisable in disposing of its patented machinery.

In this, the Court is undoubtedly sound. As everyone knows, a patent is a monopoly. While it confers no right of manufacture, use and sale on the owner, it does confer the right *to exclude every other person from manufacturing, using, and selling the thing patented.* In other words, the owner of a patent can say to everyone: You cannot manufacture, use, or sell my patented invention under any circumstances whatsoever. Such a position is legally sound and so long as the contract between the patentee or the owner of the patent and the people is in existence, this attitude may be maintained. The people have promised through their Government agents, that in consideration of their having the free use of the invention *at the expiration of the patent*, during the life of the patent the patentee may have the absolute control as to who may use, and under what conditions the patented invention will be permitted to be used; or, as before pointed out, during that period the use of the invention may be entirely withheld from the public, under any and all conditions.

It must be remembered that the United Shoe Machinery Company does not sell its principal machines but leases them, and the Supreme Court of the United States in the Dick case has unequivocally affirmed the right of the owner of a patent to dictate the terms upon which it is willing to permit others to use the invention of that patent. In the Dick case, the particular machine was a mimeographing or duplicating machine, and the owner of the patent for that machine made it a condition of a license to use, that its licensees should not use with that machine any materials, paper, ink, etc., which were not obtained from the owner of the patent. This the Supreme Court held was its right under the patent.

We cannot see how this right of control of the manner and condition of use of patented property differs in the slightest degree from the right of control of the manner and conditions of use of unpatented property.

Let us assume that one owns a house which because of its locality and particular construction and other advantages someone desires to lease, and believes that he must be permitted to lease that house and that no other house will suit him. Naturally the owner of the house can say to him: No, you cannot have the house at all. No one will question this right in the owner of a house.

However, let us suppose that the owner of the house is a coal dealer, and that he says to the person desiring to lease it, I will lease you my house, but only on one condition, and that is that you purchase all the coal which you need for heating the house from me. There is nothing unfair in that condition; the transaction is perfectly legal, and so far as we can see, there is no difference whatever in that case over the case of the United Shoe Machinery Company in leasing patented machinery.

There is one difference, of course, and that is that in the one case, the title to the property, namely, the house, remains in the owner forever or until he disposes of it by his own act, and therefore he can *forever* maintain the conditions stated; whereas in the case of patented property the rights of the owner terminate at a specific date, after which he can assert no rights of ownership and impose no condition respecting that particular piece of patented property.

We may expect the usual flood of bills in Congress to change the patent laws, and no doubt they should be changed in some particulars; but we confess we can see no way short of an absolute repeal, whereby the consideration now given a

LEGAL NOTICES

OVER 65 YEARS' EXPERIENCE

PATENTS

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DESIGNS
COPYRIGHTS &C.

INVENTORS are invited to communicate with **Munn & Co., 233 Broadway, New York,** or **625 F Street, Washington, D. C.,** in regard to securing valid patent protection for their **Inventions, Trade-Marks** and **Copyrights** registered. **Design Patents** and **Foreign Patents** secured.

A Free Opinion as to the probable patentability of an invention will be readily given to any inventor furnishing us with a model or sketch and a brief description of the device in question. All communications are strictly confidential. Our **Hand-Book** on Patents will be sent free on request.

Ours is the **Oldest** agency for securing patents; it was established over sixty-five years ago.

All patents secured through us are described without cost to patentee in the **Scientific American.**

MUNN & CO., 233 Broadway, New York

Branch Office 625 F St., Washington, D. C.

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

AGENTS WANTED

AGENTS, 500% Profit. Free Sample Gold and Silver Sign Letters for store fronts and office windows. Any one can put on. Big demand everywhere. Write today for liberal offer to agents. Metallic Letter Co., 438 N. Clark St., Chicago, U.S.A.

BUSINESS OPPORTUNITIES

A MANUFACTURING CONCERN, with an efficient sales organization covering the world, will take on a patented manufacturing specialty. If you have anything in this line which you want built and marketed, address with full particulars, Organization, Box 773, New York.

HYDRAULIC TRAINING.

BY CORRESPONDENCE in Water Power and Water Supply Engineering and Rudimentary Surveying. No advance fees asked. Water Chronicle, 34 West Congress, Detroit, Mich.

INSTRUCTION

FREE TUITION BY MAIL. CIVIL SERVICE, Normal, Academic, business, agricultural, English, drawing, engineering, real estate, and law courses thoroughly taught by mail. For "free tuition plan" address Carnegie College, Rogers, Ohio.

FOR SALE

$1 to $500 EACH paid for hundreds of U. S. and Foreign Coins dated before 1895. Send 10c. at once for Illustrated Coin Value Book, 4x7. Get posted. Clarke Coin Co. Box 155, Le Roy, N. Y.

WHY SPEND $100 for a Typewriter, when you can purchase a New Standard Visible Typewriter for $60 cash? The Wellington Visible Typewriter. Call or write for list. The Williams Mfg. Co., 309 Broadway, New York.

PATENT FOR SALE.

WATER POWER DESIGN which reduces the cost of development and increases the output efficiency, especially during floods. Water Chronicle, 34 West Congress, Detroit, Mich.

NEW AND USEFUL IMPROVEMENT in cooking vessel, U. S. Patent No. 883,652. For further particulars address Helga Lenschow, South Butte P. O., Butte, Montana.

WANTED

WANTED. To buy patents for articles that will have a large sale and can be retailed at from ten cents to $5.00 each. Practical novelties preferred. Address Sales, Box 773, New York.

PROPOSALS

OFFICE OF STATE HIGHWAY COMMISSIONER

Richmond, Va., March 23, 1915.

The Board of Supervisors of Buckingham County, Virginia, will be glad to receive proposals for the renting of Dinky Engine and cars, also seven (7) miles of rail.

Address all communications to W. J. Hubard, Clerk, Buckingham, Virginia.

G. P. COLEMAN,
State Highway Commissioner.

INQUIRIES

Inquiry No. 9431. Wanted to purchase a mold for shaping and piercing beads made of rose leaf of the consistency of dough.

Inquiry No. 9429. Wanted the name and address of a manufacturer of a machine for bleaching beeswax.

Inquiry No. 9430. Wanted the name and address of a manufacturer who can supply machinery for producing soluble coffee.

Inquiry No. 9432. Wanted the name and address of a manufacturer of watch glasses 9 inches in diameter.

Inquiry No. 9433. Wanted the name and address of a manufacturer of a material such as is used by gas mantle makers. The material is used to cover the wire frame that supports the mantle at the top and is used to protect the wire from the flame or heat of the mantle.

Inquiry No. 9434. Wanted the name and address of a manufacturer of special pins, 1/16 of an inch in diameter and ¾ of an inch long, the pins to be made of bone.

Inquiry No. 9435. Wanted the name and address of a manufacturer who can furnish grinding machines for the hollow grinding and finishing of razors. Up-to-date machines wanted.

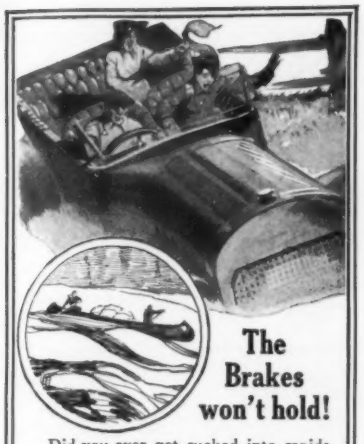
Inquiry No. 9436. Wanted the name and address of a manufacturer of rat traps having a receptacle attached into which the rat drops and drowns.

Inquiry No. 9437. Wanted the name and address of a concern that can make an oil or grease gun. West preferred. Must be able to make in quantities of 10,000.

Inquiry No. 9438. Wanted the name and address of a manufacturer of light aluminium sheets, small tubing, rods and wire, also aluminium solder.

Inquiry No. 9439. Wanted the name and address of a manufacturer of a knitting machine which was on the market some years ago. The name of the machine was the Bickford Machine. It was a hand knitting machine, weighing about 15 pounds.

Inquiry No. 9440. Wanted the name and address of a concern selling Dr. Young's E-Z Sanitary Belt.



The Brakes won't hold!

Did you ever get sucked into rapids in a canoe?

You feel the same way when your brakes suddenly fail you on a bad hill. *Remember*—your brakes are not infallible. THEIR EFFICIENCY DEPENDS ENTIRELY ON THE BRAKE LINING. If the brake lining suddenly goes bad—becomes friction shy—you have no more control over the car than you would have on a barrel shooting Niagara.

Thermoid HYDRAULIC COMPRESSED Brake Lining-100%

Thermoid is Brake Lining all through—not merely on the surface. It is a substance which has been hammered by hydraulic compression to a uniform density—it is not a stringy, loosely woven fabric with only friction surfaces.

Thermoid will still hold even though worn paper thin. It is 100% brake lining.

Watch your brakes. Guard your safety with Thermoid.

Thermoid Rubber Co.
Trenton, N. J.

Cannot be burned out nor affected by oil, heat, water, gasoline, dirt.

OUR GUARANTEE: Thermoid will make good or we will.

VENUS PENCILS

Made in 17 degrees (6B softest to 9H hardest) of never varying, uniformly graded quality, also 2 copying. Write on letterhead for free trial sample and booklet.

VENUS

American Lead Pencil Company
217 Fifth Ave. New York

$1.00

VEEDER Counters

register reciprocating movements or revolutions. Various designs to fit machines in almost every line of business. Probably there is one just suited to your needs. Booklet free.

Cyclometers, Odometers, Tachometers, Counters and Fine Castings.

Veeder Mfg. Co.
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We have issued a very interesting Catalogue on "Pergolas" and Garden Accessories showing a series of new designs that can be had free on request. Catalogue "Z-28" for Pergolas, also columns for Pergolas and Garden Accessories. Catalogue "Z-40" for Exterior and Interior Wood Columns.

Hartmann-Sanders Co.
Exclusive Manufacturers of
Koll's Lock Joint Patent Stave Columns
Suitable for
PERGOLAS,
Porches and Interior Use
Main Office and Factory:
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THEY CAN NOT COME APART — KOLL'S PATENT

patentee, so far as his absolute right of exclusion of all others from the practice of his invention is concerned, can be modified, without materially affecting that promotion of the useful arts and sciences contemplated by our Constitution and upon which is founded that wonderful commercial progress to which our present civilization is indebted.

In other words, if we give a man a patent at all, it can only be a patent which will give him the absolute right to say on what terms others may be permitted to manufacture, use, and sell his invention.

Detroit's Trade-mark Contest

"Made in U. S. A." Trade-mark Which Was Awarded $500 Prize by Detroit Board of Commerce Feature of "Made in U. S. A." Exposition

A NOTABLE feature of the "Made in U. S. A." Industrial Exposition at the Grand Central Palace was the "Made in U. S. A." trade-mark which was awarded the $500 prize offered by the Detroit Board of Commerce. It was chosen from 119,000 submitted by citizens of the United States, and is the joint effort of James Harley Nash, a designer, and of Clowry Chapman, a trade-mark specialist, both of New York.

A condition of the contest was that this design was to become the property of the people of the United States, and not merely of Detroit business men. In appreciation of this broadly patriotic attitude of the Detroit Board of Commerce, the El Paso, Texas, Chamber of Commerce, came to the front with a further prize of $50.

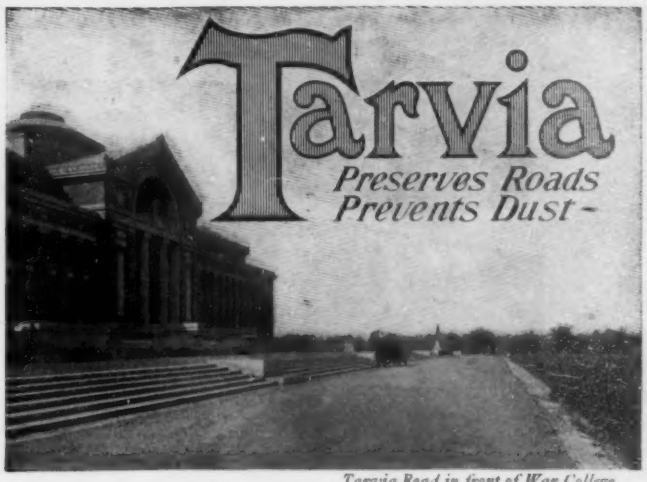
The award of the prize was given a further national appeal by judges having been chosen from other cities. These judges were: James Keeley, editor and publisher of the Chicago *Herald;* Charles Daniel Frey, a well-known designer of Chicago; Edward Freschl, president of the Holeproof Hosiery Company of Milwaukee; Orson D. Munn, patent and trade-mark lawyer of the firm of Munn & Co., New York; and Charles B. Warren, president of the Board of Commerce of Detroit.

The winning design was submitted in color and in black. It shows an eagle in silhouette on whose outspread wings appear the words "Made in." Below the eagle is the word Detroit, surmounting the letters U. S. A. In the colored design the eagle is blue and the words "Made in" are white, while "Detroit" and "U. S. A." are in red.

In making the award, the judges said: "The design is simple, strong, and mechanically perfect; it can be easily woven in textile fabrics, and is so open that it will reproduce perfectly down to a quarter of an inch; its use as a stencil, stamp or metal die presents no difficulties, and its character is such that it will print satisfactorily in any medium or by any process. The design is elastic in that the name of the city can be omitted or widened, or contracted, without destroying or impairing the composition. The design, also, is thoroughly American in atmosphere, composition, and color scheme. Its merit is simplicity, and legibility will be a strong argument for its adoption and use on American merchandise in foreign trade."

The Use of Patented Pavements by Cities

MANY laws, city charters and city ordinances have been enacted forbidding the use of patented materials or machines in municipal work, according to the *Engineering News.* These laws have had their origin partly in some notable cases in the past where patented devices have been used at exorbitant cost to the taxpayers as a result of dishonest collusion with city officials, and partly in cases where suits for very heavy damages have been brought against cities because of some use of a patented device without consent of the owner of the patent. Such laws, however, have proved impracticable of complete enforcement. The progress of the arts is largely reflected by the issue of patents, and to wholly prevent a city from using any patented device until the patent had expired, 17 years from the date of its



Tarvia Road in front of War College, Washington, D. C.

Better Roads and Lower Taxes—

THE automobile has radically changed the problem of the road builder. What is required now is a form of road construction which will not only give a good surface the whole year round, but which will be able to withstand motor traffic.

Tarvia furnishes the solution.

Tarvia is a dense, viscid coal tar product. It is made in several grades to meet varying road conditions. Used in road construction it forms a matrix about the stone, making a tarvia-concrete which is waterproof and automobile-proof. As it is slightly plastic it is not abraded by automobile driving wheels, but is simply rolled down smooth allowing no dust or mud to form.

The cost of maintenance is so greatly reduced by the Tarvia treatment that its use is a real economy. Suburban streets should be treated with Tarvia to secure a handsome, cleanly, mudless pavement at low cost. County and state thoroughfares and highways should be treated with Tarvia to keep down maintenance expense.

Special Service Department

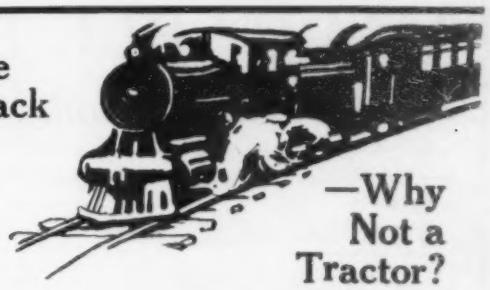
In order to bring the facts before taxpayers as well as road authorities, the Barrett Manufacturing Company has organized a Special Service Department, which keeps up to the minute on all road problems. If you will write to nearest office regarding road conditions or problems in your vicinity the matter will have the prompt attention of experienced engineers. The service is free for the asking. If you want *better roads* and *lower taxes,* this Department can greatly assist you.

BARRETT MANUFACTURING COMPANY

New York Chicago Philadelphia Boston St. Louis Cleveland Cincinnati Pittsburgh Detroit Birmingham Kansas City Minneapolis Salt Lake City Seattle

THE PATERSON MFG. CO., Limited: Montreal Toronto Winnipeg Vancouver St. John, N. B. Halifax, N. S. Sydney, N. S.

A Locomotive Runs on a Track



—Why Not a Tractor?

THE Caterpillar Tractor is locomotive and track in one. There's an endless track—with steel plates to act as ties, and heavy steel rails on which the small truck wheels run smoothly along however soft or rough the ground.

The Caterpillar "45"—the no-front-wheel type—is well fitted for an all-purpose, small farm tractor.

It turns in its own length.

With its 80-inch-long track's grip on the ground it doesn't slip or mire—whether on bad roads or no roads.

Its big bearing surface prevents packing the soil in plowing soft land.

It does not injure roads or bridges, and you can seldom sink it in mud. Its powerful 4-cylinder motor furnishes power for all belt work.

The Tractor that 6 European armies are using in increasing demand for engineering and road construction work—the only *real* Caterpillar—trade-marked and patented.

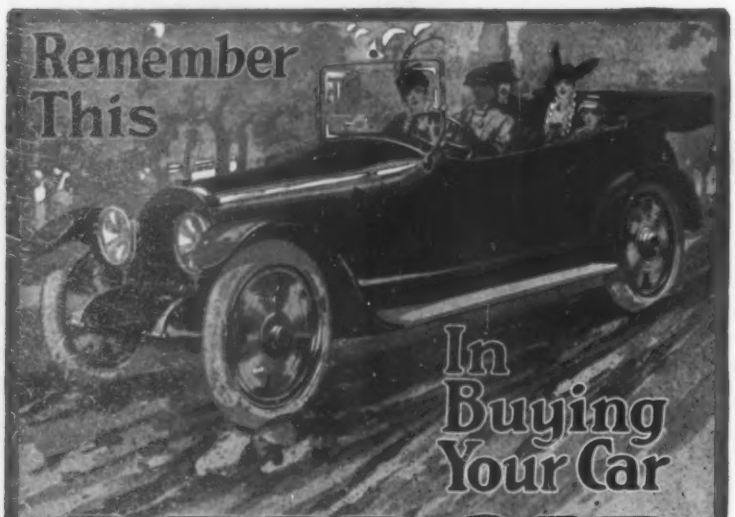
Built to stand up under the hardest usage, with lowest upkeep cost.

Write for Bulletin G-H 247 and tell us what your work is.

CATERPILLAR
Reg. U.S. Pat. Off.
"45"

Don't say Caterpillar unless you mean Holt!

The Holt Mfg. Co.
(Incorporated)
50 Church St., New York
Stockton, Cal. Spokane, Wash. Peoria, Ill.



DETROIT SPRINGS
Mean Comfort

Roll of Honor
The Names shown below represent some of the users of Detroit Springs

Pleasure Cars
Cole — Lyons-Knight
Dodge Brothers
Marmon — Hupmobile
National — KisselKar
Oakland — Pathfinder
Great Western

Trucks
Denby — Republic
Federal — Signal
G. M. C. — Standard
Krebs — J. C. Wilson

A common method of securing the effect of easy riding springs is to partially deflate the tires. This is a very expensive deception as it increases the wear on the tires.

A car equipped with Detroit Springs rides with perfect comfort when the tires are inflated to their highest point of efficiency.

Remember this in selecting your car. Ask for a demonstration in a car fitted with Detroit Springs. Then ask for a ride in a car with "ready-made" springs and fully inflated tires.

Detroit Springs are not "ready-made"—they are designed and built especially for the particular car upon which they are used.

You Know Them by the Lubricating Cups

The ends of each leaf are saucer-like depressions filled with a long-lived lubricant that prevents squeaking under all conditions.

Detroit Springs are guaranteed for two years, twice the length of the ordinary spring guarantee.

Send for the interesting book, "From the Ore to the Motor Car."

Detroit Steel Products Co.
2230 E. Grand Boulevard — Detroit, Michigan

VALUABLE BOOKS
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issue, would place the city hopelessly behind the times.

An interesting review of the status of the laws covering the use of patented paving materials by cities was recently given in a lecture delivered before the highway engineering class of Columbia University, by George C. Warren, president of Warren Brothers Company, Boston, Mass. Mr. Warren is, of course, an interested party, but his wide experience in litigation over the use of patent paving should make his summary authoritative.

Cases involving the legality of the adoption of patented pavement by municipalities have been decided within the past 20 years by the highest courts in the States of New York, New Jersey, Ohio, South Carolina, Oregon, Missouri, Maryland, Louisiana, Kentucky, Michigan, Kansas, Iowa, Indiana, Idaho, Oklahoma, Pennsylvania, Tennessee, Massachusetts, California, Montana, Washington, Wisconsin, and Illinois.

With the exception of the last two States, the final decision in all of the States is to the general effect that, where the owner of the patent voluntarily surrenders his exclusive rights and agrees to allow any contractor to use the patent, on the payment of a reasonable price, all the competition which the law requires is provided. Under such regulations, patented pavements may be laid and contracted for by municipalities; and any State law which prohibits the adoption of a patented pavement by municipalities is unconstitutional, because it attempts to prevent the exercise of the federal patent franchise, which is based on the United States Constitution.

Of the two States in which decisions of the final courts have been adverse to patented pavements, the Wisconsin legislature promptly amended its law so that patented pavements may be used; and Illinois stands alone as the only State in which there is practically a prohibition of the use of patented materials in municipal assessment work.

The courts of most of the States above referred to have declared that the competition required by the State laws is provided if the owner of the patent files with the municipality a binding agreement under which, at a certain price, he will sell the patented portion of the pavement, which patented portion is generally confined to the wearing surface, to any responsible bidder; so that all such bidders may compete with the patentee or his agents for the construction of the whole pavement.

Inventors and the Piano

WHEN we realize the multitude of inventors who have tried their hand at devising mechanism for the piano it is surprising to note that, although it has undergone many alterations, the check action invented by Erard nearly a hundred years ago is still in use to-day in all its essential features. Most inventors in this line have directed their attention to improvement in the hammer and damper mechanism; but it is reported that recently an important improvement has been made in the key mechanism that is quite revolutionary. The ordinary key works on the fulcrum principle, and it is necessary to counterweight each key with lead, and although the keys work easily there is a very considerable weight of material to be put into motion. The new plan is to delicately balance each key on a rocker, thus producing the "cradle" keyboard. This plan enables the key to respond more readily to the touch, and repeats more rapidly, and as the damper is operated quicker rapidly succeeding notes all come out distinctly, and the ordinary doubling of sounds is overcome. Greater delicacy is claimed with no loss in power.

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The Heavens in April

(*Concluded from page 318.*)

away on the 17th. She is in conjunction with Uranus on the 8th, Venus on the 10th, Jupiter on the 11th, Mars and Mercury on the 12th, Saturn on the 19th, and Neptune on the 22nd. The conjunction with Venus, which occurs at 10 A. M. on the 10th, will afford a very good opportunity to pick the planet up with the naked eye in the daytime about 2 degrees to the southward of the Moon.

Mellish's Comet.

Later elements of this comet indicate that its perihelion passage will occur in the latter part of July, at a distance slightly exceeding that of the Earth. The comet should then be pretty bright, but will be too far south to be well observable in this country. No exact ephemeris of its position is at hand, but it appears that on April 1st it will be in about 18 hours 2 minutes right ascension and a little more than 1 degree south of the celestial equator, and moving slowly eastward and southward. It is already a conspicuous telescopic object.

Princeton University Observatory.

Freeing Condensed Steam From Oil

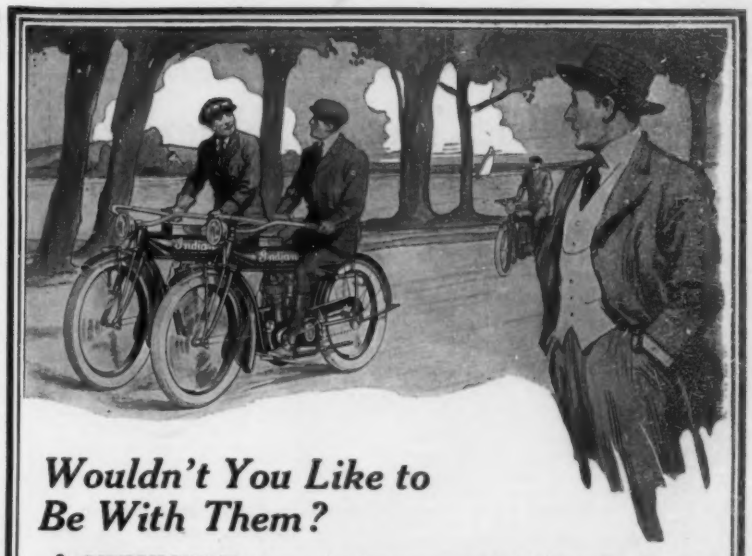
CONDENSED steam furnishes water which is in some particulars especially adapted for boiler supply. Since it is, of course, a distillate, it has been freed from the mineral matter which forms the troublesome deposit in boilers known as scale. Furthermore, it retains a considerable degree of heat. But unfortunately such re-use is rendered difficult in spite of these advantages by the fact that the steam in passing through the engine carries with it a certain amount of lubricating oil which subsequently fouls the condensate. When water thus contaminated is used to feed boilers, the oil adheres to the walls and gradually accumulates until it is present in sufficient quantity to retard the passage of heat to such an extent that there arises the danger of its causing superheating of the hot surfaces.

Obviously, therefore, this oil must be extracted from the water before its re-use in boilers. Such extraction is difficult because the oil is present not in drops, but largely in the form of tiny particles so intimately mixed with the water as to form an emulsion. In such form even a long period of rest is not sufficient to separate it entirely; likewise filtration through coke, sponges, cloths, etc., is only partially successful.

Better results are obtained by chemical means. In this process soda and sulphur containing clay are added to the water. This method, however, is open to the objection that it requires elaborate and costly apparatus which demands careful attention, which obviously makes its practical application difficult.

A third method seeks to free the steam from oil before condensation. Various forms of apparatus have been constructed for this purpose, but the condensate always contains some trace of oil, so the trouble is at best deferred. Recently, however, a new process has been advocated, which claims to render the water entirely free from oil without great expense or trouble. This is known as the Halvor-Breda-A.-G. patent process. It is described in a recent number of the *Technische Monatshefte* by Dr. Hanus Günther. According to him, it utilizes the fact that an electric current conducted through water containing oil causes the oil to collect in foamy flakes, which can easily be removed by mechanical means.

The apparatus consists of a large wooden container in which numerous iron plates are placed as electrodes. The oily water coming from the condensers flows slowly past these plates. The electrodes beneath the stream of water draw the tiny particles of oil to them and form a sort of oily slime out of them. When the current is reversed this slime is loosened and rises in flakes to the surface of the water. Here it can be skimmed off completely. If the water, after being thus deoiled, be passed through a gravel filter, the product is crystal clear and entirely



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Food Production in the United States

CONSIDERING the high and constantly increasing cost of food, the report of the Commissioner of Agriculture cannot be regarded as in the least reassuring. While he finds that the crop yields per acre for the whole country were 2.3 per cent better during the present year than for the past ten years and the average yield of all the staple crops was 9.4 per cent greater than last year, still there was not only a relative, but an absolute decrease in a number of staple food products, such as corn and meats, the figures being as follows.

In cattle, sheep and hogs there has been an absolute decline—in cattle, from the census year of 1899 to that of 1909, of from 50,000,000 head to 41,000,000; in sheep of from 61,000,000 to 52,000,000; in hogs of from 63,000,000 to 58,000,000. Since 1909 the tendency has been downward, and yet during the period since 1899 the population has increased over 20,000,000. This situation exists not in a crowded country, but in one which is still in a measure being pioneered, in one which, with 935,000,000 acres of arable land, has only 400,000,000, or 45 per cent, under cultivation, and in one in which the population per square mile does not exceed 31 and ranges from 0.7 person in Nevada to 508 in Rhode Island.

Discussing this situation the Commissioner remarks: "Just what the trouble is no one is as yet sufficiently informed to say. It can scarcely be that the American farmer has not as much intelligence as the farmer of other nations. It is true that the American farmer does not produce as much per acre as the farmer in a number of civilized nations, but production per acre is not the American standard. The standard is the amount of produce for each person engaged in agriculture, and by this test the American farmer appears to be from two to six times as efficient as most of his competitors."

Coming from one in his position, this statement is rather surprising and the argument altogether fallacious, as it is very evident that what the present-day farmer takes out of the soil by superficial methods of tillage and treatment his successors will have to pay back with heavy interest in the way of additional labor; but he admits that the future aim must be, "while maintaining supremacy in production for each person, to establish supremacy in production for each acre."

Random Reflections

By Irresponsible

SOMEBODY once said that patriotism was a sentiment felt only by fools. There is a certain broad point of view from which this remark looks true, but the view is a little too broad for accuracy; just as a glass which gives a broad field of vision does not usually give extreme sharpness of definition. Broad-mindedness can be pushed to extremes: the transition is not great from regarding all views with equal interest to regarding all views with equal indifference. This point is made by Mr. Chesterton in his pertinent query: what is more broad-minded than a turnip? But without being broad-minded to the verge of impotence I have a qualified sympathy with that remark

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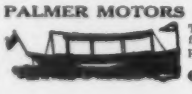

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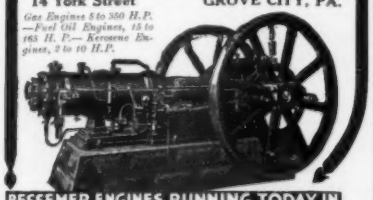

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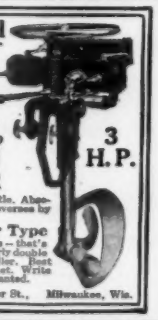

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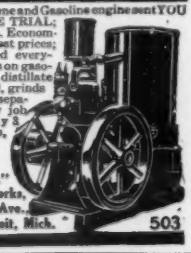

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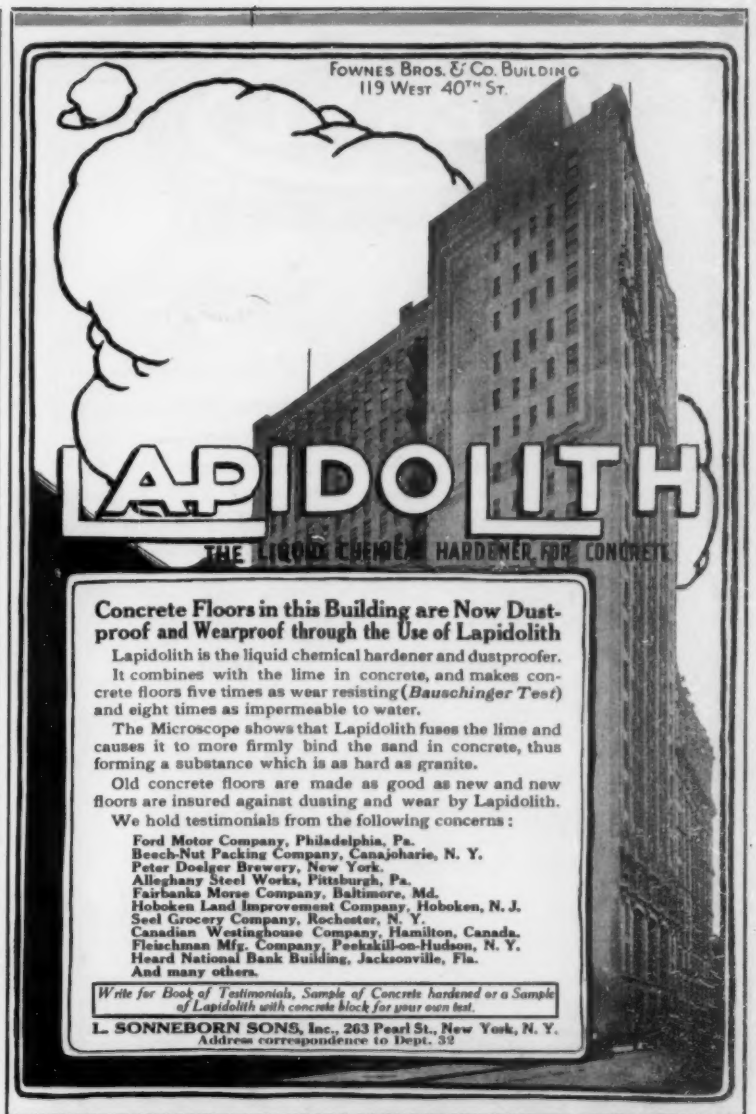

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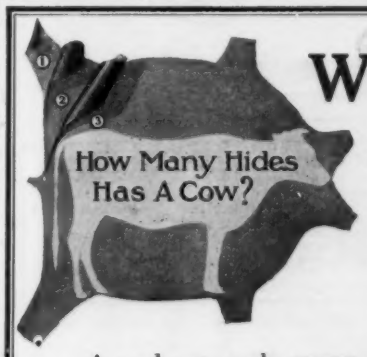

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about patriotism: I think that misplaced patriotism is a nuisance, but I also think there is a sense in which patriotism is very necessary. It is a human thing and so, of course, it has its drawbacks: it is also something for which millions of human beings have died, and so there is probably a good deal in it. To modify a certain celebrated remark, all people have not been fools always.

It seems to me that there are two sides to patriotism as one usually meets it: the patriotism which means love for one's country, and the patriotism which means dislike of other peoples' countries. I think the second kind is a nuisance, and its possessors fools. The fools may, of course, be very able men, great lawyers, merchants, writers, or great scientific men. But have you never met indisputably clever people who impressed you as being fundamentally fools? That is the kind of foolishness I mean. I believe myself that this peculiar and deceptive kind of foolishness is due merely to a lack of a correct sense of proportion, which accounts for the fact that there are really clever politicians who take themselves seriously. Probably we all differ from one another in our sense of proportion, but we feel instinctively that the differences should be kept within certain limits. I may say that music is a greater art than painting, and while you may not agree, I don't suppose you would think it a necessary consequence of that statement that I am a fool. But if I said that ragtime was the greatest musical form yet created, you would, I sincerely hope, consider me a fool. A patriot may, in this limited sense, be a fool.

I, for instance, am an Irishman, and there are certain Irish characteristics which attract me immensely; but I have no desire to force them on the rest of the world. I want to keep them: I shouldn't like to see them die out; but I don't clamor for them to be made universal. I don't want to turn Englishmen into Irishmen. The Englishman as he is, with all his objectionable self-complacency, interests and amuses me enormously. And it is because his desirable qualities are *different* from those of the Irishman, that I want him to go on existing. I should like to emphasize that, because I think it an important argument for the desirability of patriotism.

We should be patriotic, in the sense of insisting on the excellencies of our own countries, because a number of *different* good things is what the world wants. Truth is many-sided, and we want a lot of different points of view. We want to keep in the world the French view of things, the German view, the Russian view, and all the other views. We want distinct nationalities and distinct national characteristics. We want to encourage in the whole world the same diversity that we encourage in any one country. We don't want Joseph Conrad to write like Charles Dickens, and we don't want either of them to write like William Shakespeare. They are valuable not only because they write good stuff, but because they write different stuff. A second-rate man imitating Shakespeare is not producing anything very valuable, but a second-rate man writing something quite different from Shakespeare is probably producing something worth while.

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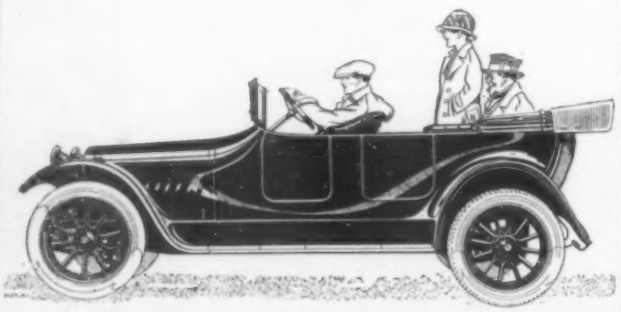

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secondary standards of length, and in the latter it is employed for pendulum rods, compensating devices for torsion pendulums and balance wheels correcting the secondary error of temperature in chronometers. Dr. Guillaume has done a large amount of research work in connection with iron-nickel alloys, in the course of which he also discovered platinite.

Producing the Effective Temperature of the Sun

By Our Berlin Correspondent

WHILE enormous strides have been made lately in the production of extremely low temperatures, resulting in some most valuable discoveries in the field of science and engineering, high temperature work has been relatively less successful, in spite of the very important results likely to be derived in this connection. In fact, until very recent times, the temperatures of many of our usual sources of light, such as carbon filaments and arc lamp craters, could not be gaged with even a fair degree of approximation.

In an address delivered before the Society of National Culture not long ago, Dr. Otto Lummer, the well-known physicist of Breslau University, drew attention to the fact that the temperature of the positive crater of arc lamps, as determined by himself, viz., about 4,500 deg. Cent., is the highest terrestrial temperature so far realized. Whereas in the case of terrestrial illuminants the actual temperature can be gaged, we must be satisfied with determining the *effective* temperatures of celestial bodies. Supposing the sun to radiate like a "black" body, that is, a body perfectly absorbing any incident radiation of any wave-length whatsoever, its "effective" or "black" temperature can be determined from the sum total of radiation sent to the earth (solar constant), the figure thus found being about 6,000 deg. Cent.

Now, Dr. Lummer, in the course of his recent work, has succeeded not only in reaching, but in considerably exceeding this effective sun temperature. In this connection he was guided by the fact brought out by his previous experiments, that the temperature of the two craters of an arc lamp burning in the open atmosphere cannot be driven beyond a maximum figure (4,500 deg. Cent.), this temperature thus being constant within wide limits of current intensity and arc length.

The constancy of this temperature could be due to the carbon's reaching either its melting or its boiling point. Dr. Lummer having yet then been unable to melt the carbon of arc lamps, and the melting of carbon at ordinary pressures being considered unfeasible, he could not but conclude that the temperature observed was the boiling point. Experiments made to ascertain this, however, brought out the fact that the carbon was actually reduced to a liquid condition, and after separating the liquid from the solid phase and investigating at several degrees of vacuum the solid part of the evaporating crater, a regular drop in the temperature of the crater was observed with decreasing pressures. Dr. Lummer then proceeded to undertake a series of tests at increased pressures, when pure carbon arc lamps were found to form nothing like stationary arcs with large craters corresponding to the current intensity. Special means, of which details cannot yet be published, had therefore to be devised in order to produce a true, stationary arc with crater temperatures corresponding to the increase in pressure. In fact, Dr. Lummer succeeded in ascertaining a regular increase in temperature, with rising pressures, a surface brightness about eighteen times the normal figure being reached at about 20 atmospheres, corresponding with a temperature of about 7,800 deg. Cent.

Temperatures exceeding by about 3,000 deg. Cent. the so far highest terrestrial temperature (4,500 deg. Cent.), were thus for the first time produced in the laboratory. Whether still higher temperatures can be obtained in this way obviously depends on the possibility of producing true arc at even greater pressures.

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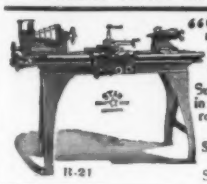

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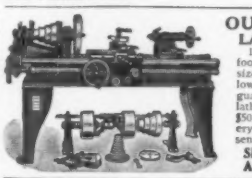

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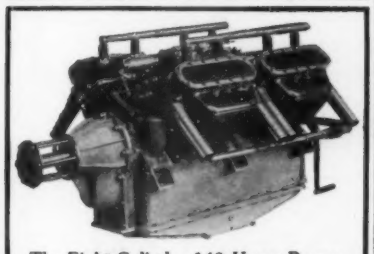

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lamps, when manufactured in a commercially suitable form, will play an important part in the art of illumination, allowing, as they do, the radiation of an enormous amount of light from a relatively small surface. It is also hoped that this lamp may prove more economical than any other source of artificial light. Though comprehensive experiments will still have to be made in this connection, there is every reason to suppose that craters heated up to sun temperature will give out a light similar to real sunshine, that is, some sort of "artificial sun light." The possibility of using the new lamp for therapeutical purposes, e. g., for producing greater amounts of ultra-violet rays than have so far been feasible, will likewise be investigated in the further course of these promising experiments.

World's Largest Soup Kitchen

THE Brussels soup kitchen organized by the London Commission for Relief is now undoubtedly the very largest in the world. Nearly 50,000 people entirely destitute wait in the "bread lines" every day, and over 6,000 gallons of soup and 4,000 kilogrammes of bread are daily distributed to them. Unlike the "bread lines" I have seen in America, these are all people of one nationality, and all with a common and undeserved misfortune. Some are transients, it is true, but the large majority are people of Brussels. As one of the canteen directors said:

"They are of all classes, but we know none of them save by number, because no matter what their station or the extent of their misfortune, they still have *l'amour propre*, and many of them if they were compelled to write their names on coupons when they get the soup would rather starve than take it."

The soup for those pitiful flotsam and jetsam of war is all prepared in the large storehouse of the International Express Company Van Gand. More than 100 people are engaged in this work. Among them are former chefs of some of the leading hotels of Brussels, who give directions as to the kind and quality of the soup, its ingredients, and their proportions. Under them are those who clean the vegetables—potatoes, carrots, beans, etc.—and prepare the meat. This entire staff is composed of volunteers, except the chefs, who receive at the most half a crown a day.

From three o'clock in the morning, when the cooking of the first 5,000 gallons of soup is started, the scene in the circus-like storehouse of the Express Company is one of tremendous activity, with the moving figures of the 100 white-clad chefs, the fires ablaze under scores of immense cauldrons—all dimly seen through the shifting clouds of pungent steam rising from the boiling soup.

When the soup is cooked it is sent, under the seals of the Commission and under the protection of the American flag, in large lorries to the twenty-one canteens, scattered all over Brussels. These canteens were formerly schools, dance halls, Turkish baths, etc. During the morning, wherever one goes, women and children may be seen coming and going with pitchers of steaming soup and their ration of bread under their arms.

While Brussels is being fed, the 100 trained hands at the soup kitchen start preparing vegetables and meat for the next day. It keeps them busy. On December 24 the staff had to prepare for Christmas—which was a normal day so far as this work is concerned, although the director told me rather pathetically that he was trying to make *"une soupe de fete"*—the following: 1,000 pounds of potatoes, 1,800 pounds of meat, 2,400 pounds of celery and carrots, 1,000 pounds of onions, 1,000 pounds of South Carolina rice, and 1,000 pounds of noodles made from American flour.—*The London Daily Telegraph.*

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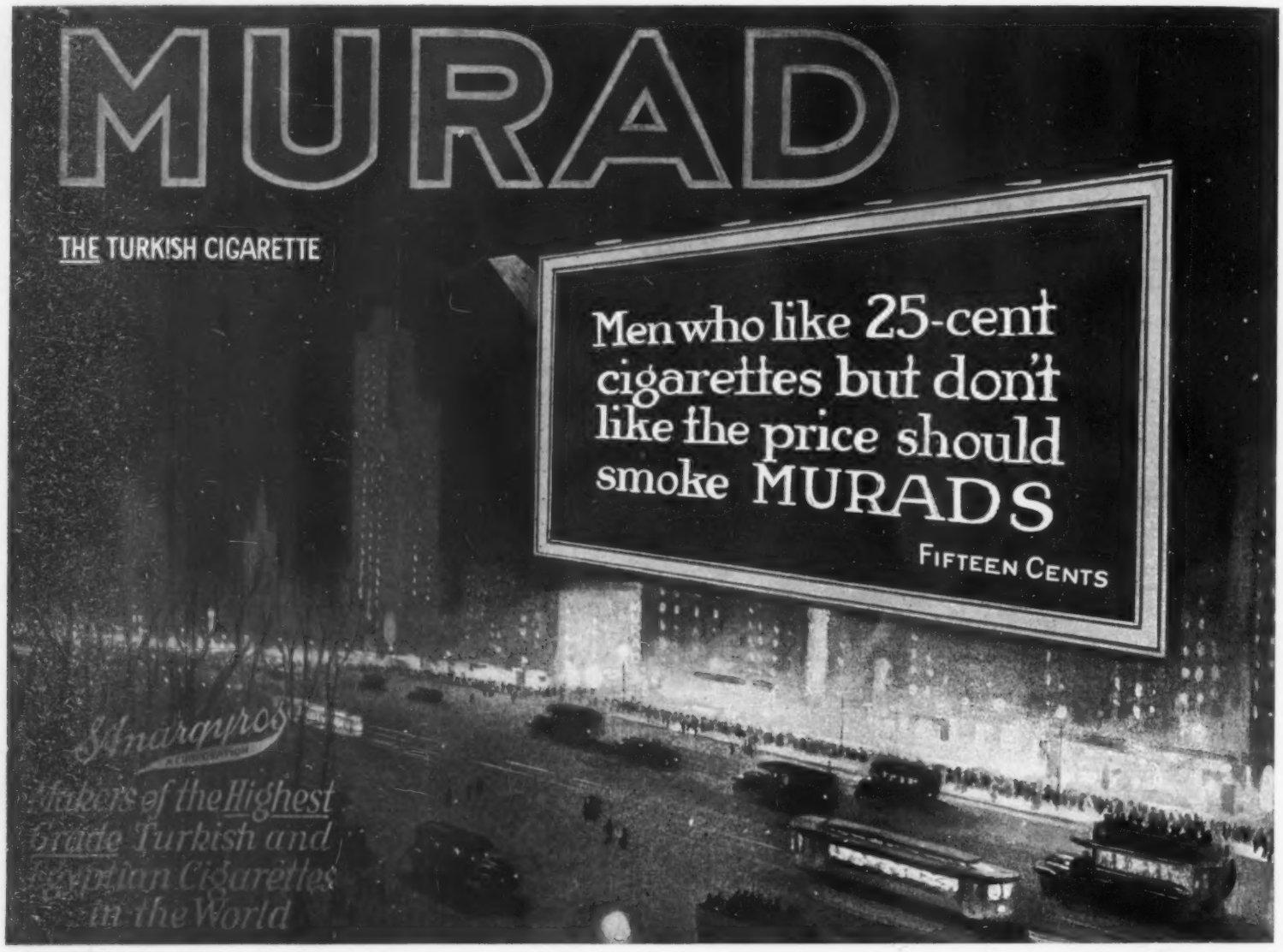
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feine is extracted by volatile solvents, such as alcohol and benzol, after the cellular tissue of the coffee bean has been softened by steaming and the caffeine salts have been decomposed by means of acids or bases. This process is applicable only to raw coffee. Analyses of the product show that at least one sixth part of the ingredients which give coffee its flavor and aroma are removed with the caffeine. Dr. R. Ditmar states, in *Die Umschau*, that L. Klein has patented a new process by which the caffeine can be almost completely extracted with little loss of the flavoring and aromatic ingredients. Raw coffee is mixed and stirred, under pressure, with slaked lime and soda. The stirring is continued while the mass is gradually heated to 200 deg. Cent. (392 deg. Fahr.) and kept at that temperature until the coffee beans begin to swell. The coffee is then transferred to an apparatus in which it is first dried and then heated to about 160 deg. Cent. (320 deg. Fahr.), so that it is partially roasted.

Engineering Openings in Russia

THE British Consul-General at Moscow has forwarded a report received from a reliable source in regard to the machinery import trade of Russia, which contains a list of various classes of machinery which have hitherto been imported from various Continental countries, but which it is considered might now be replaced by British manufactures. It is stated that about fifteen years ago German machinery makers sent to Russia representatives who noted what had been supplied by English firms, copied some of the advantages, and proceeded to remedy defects which were pointed out by users, with the result that in a short time machinery was delivered from Germany which met users' requirements, and was delivered at Moscow at lower prices than English machines. All classes of machinery entering Russia have to pay duty by weight, and while English makers, with few exceptions, have practically ignored the rôle that weight plays when duty is imposed upon it, the Germans have attached importance to it. In many machines there are heavy, rough cast-iron and other parts which could be made in Russia at a price which would considerably reduce the total cost of the machine to the purchaser delivered at his mill or works. This is a phase in the machinery trade worthy of consideration by English producers of heavy, rough machinery who are desirous of entering the Russian market. With the development of municipal institutions in Russia it is asserted that there is a great field for contractors capable of installing water works, gas works, electric light and tramway plant, etc., but recently German firms have invariably obtained such contracts. One of the causes contributing to their success in this direction has been the ready way in which the German business houses have met purchasers in regard to terms of payment, etc.; this has been possible owing to the fact that the interests of various German makers have been so interwoven that they could obtain financial support where an isolated English supplier would fail. Moreover, whenever a big scheme has been under consideration, the German combines have had their representatives continually in touch with those who have had the placing of the orders, and by constantly assisting them, free of charge, to draw up specifications, these representatives have succeeded in getting specified just those classes, designs, models, and sizes which could only be obtained from German firms. British machinery manufacturers, who wish to obtain a share of the Russian orders hitherto placed in Germany, are urged to commence the necessary propaganda at once, and not to wait until the war has terminated. They should prepare their circulars in the Russian language, and cause them to be distributed to likely customers through reliable agents. The distribution of circulars in a haphazard way will do little good; they should be sent out by firms or individuals on the spot who know exactly who are the users of the machines described.—*Engineering*, London.

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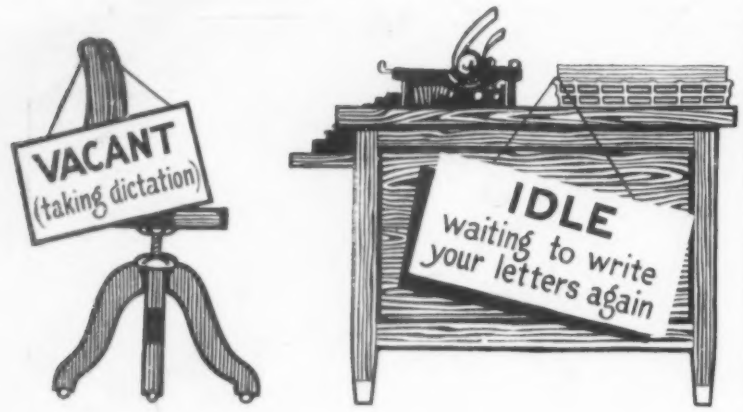

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The Zeppelin Raid on Paris

By C. Dienstbach

FOR the first time the reason of a Zeppelin attack is known with certainty. It was officially announced that the recent aerial night raid on Paris was made in retaliation for what is claimed to have been an unjustified attack on the non-military city of Schlettstadt by a French aeroplane. Hitherto Zeppelin raids seemed to have no very clear object in view beyond more or less indiscriminate bomb-dropping, if the published accounts may at all be trusted.

If these attacks were really aimed, as many believe, at private property and non-combatants, they would be far more senseless and inefficient than we have a right to expect of the highly efficient German army and its General Staff. The obvious difficulty of aiming dropped missiles from a mammoth aircraft, intent on dodging hostile fire, would play no part, as the target offered even by a small town would be immense, and about half of this area would be roofs. But to drop a few heavy, shattering high-explosive bombs on a town would be literally beside the mark. One half of them should more or less harmlessly drop into streets or yards; the remaining two or three might be expected to smash two or three houses. What does the destruction of two or three houses amount to compared with the devastation demanded in the legitimate bombardment of a village used as a stronghold? If a Zeppelin intended anything like making a businesslike job of a savage attack on civilians it would surely drop at least one hundred twenty-pound bombs, suspended under its length, at the rate of three a second, by electrical release, possibly the melinite shells fired from howitzers. (Each Zeppelin carries a fair-sized dynamo for searchlight and wireless.) Some fifty of the bombs would be most likely to hit houses, but it is hardly the nature of an air attack to copy the plan of a bombardment on land. To turn aerial carrying capacity, limited even with a Zeppelin, into smashing force seems wasteful. The air fighter, on the contrary, depends on starting an avalanche rolling—on furnishing only the salient point, or rather an endless multitude of such points, for spontaneous destruction.

The process is like an epidemic starting from a thousand germs, partly perishing, partly resisted. This banishes high explosives, which scatter too much for efficient ignition. Ancient Greek fire, which, unlike gasoline, could not be extinguished by sand, let alone water, and merrily blazed away on the waves, is the weapon for aircraft. But what folly to drop seven or eight rather inferior modern incendiary bombs, as stated of the recent Zeppelin raid, which started a few fires. The Zeppelin becomes a mechanical Attila, the true scourge of God, the moment it scatters over a town (on the windward side) one thousand two-pound torches made of an adequate modern imitation of unextinguishable Greek fire; in other words, an extremely slow, hot-burning explosive. The technical problem of lighting a slow match safely by electric contact in most rapid succession inside each torch as it drops is easily solved. The steel shell of a torch or "fire arrow" must also be strong enough to allow of its piercing roofs after dropping from a great elevation. If these missiles lodge invisibly at night (burning at first only inside) they are all the more irresistible. Now, such a Zeppelin attack would not be more savage than those first mentioned; but, directed mostly against property only, so much less so that it might under certain conditions be intentionally resorted to, it is quite conceivable that Germany would answer the actual starving to death of her women and children, if that were possible, by a modern repetition of the great fire of London. The "attack on London," as it is popularly fancied at present, would engender worse than useless hate.

But a modern "London conflagration," hopelessly beyond control from the outset, perfectly feasible because Zeppelins found their way irresistibly and unfailingly to other darkened British cities in night and fog, offers a different outlook—an outlook which tends to strongly prove the advisability of keeping religiously, even in this horrible war, to the wisely established rulings of international law, whether they affect blockades or bomb-dropping.

In the light of such considerations, "Zeppelin raids" to date appear rather as what they probably were—casual and cautious first trials of actual war conditions for moral effect without intent of true fighting; or, in the most recent case, an intentionally limited and chiefly moral punishing action. Dropping missiles for "legitimate" military tasks, on the other hand, seems already largely discredited as too erratic in the face of defending artillery.

Our Neglected Aquatic Foods

ASIDE from its well-known activity in conserving the resources of the country in food fishes and other aquatic animals belonging to our habitual dietary, the United States Bureau of Fisheries has long been conducting inquiries into the potential value and possibility of using various aquatic products which are wholly neglected or but inadequately utilized in this country. An example is the sea mussel, a cheap, abundant, and excellent food, but one rarely seen on American tables. The bureau issued several reports calling attention to this food, but without accomplishing the desired result. Finally, early in 1914, a more energetic campaign was inaugurated in Boston, where one of the leading hotels was induced to add the sea mussel to its bill-of-fare. At the same time the matter was given publicity in the newspapers, with the result that in a few months mussels were being served and given a conspicuous place on the menus of over seventy of the principal hotels, restaurants, and clubs of the city. Having thus become familiar to the public, mussels were placed on sale by retail dealers and vendors, who were furnished with large placards giving the product the endorsement of the bureau, and wide distribution was made of a circular explaining the merits of mussels, and giving a number of recipes for cooking them. Finally, the members of the police force were supplied with mussels and circulars, in order that the policemen's homes in all parts of the city might serve as foci of information on the subject. This propaganda is to be extended to other parts of the seaboard. As the mussel is suitable for canning, its use will probably spread to all parts of the country. Preliminary steps have been taken toward a similar campaign in behalf of the dogfish. At present this fish is not only not utilized to any extent for food, but is a serious scourge to the established fisheries on account of its rapacious habits.

Hypnotism

HYPNOTISM is associated in the minds of many persons with the vaudeville stage; they think of it as a sort of psychological charlatanry in which the performer, sometimes through the assistance of confederates in the audience, who volunteer as subjects, amuses, but deceives, the spectator.

"The truth of the matter is," holds Prof. P. H. Fogel of the Department of Philosophy of Princeton University, "that the conscious processes underlying hypnotic phenomena, namely, attention and suggestion, are among the most fundamental in human life.

"College courses in the psychology of hypnotism, and similar phenomena are largely confined to the greater universities, for in the small college, psychology is frequently used merely as an introduction to the philosophical consideration of the conventional problems of knowledge and reality, and the teaching staff is usually not large enough to take up all the phases of a psychology of life.

"The literature on hypnotism is voluminous, and the phenomena themselves are of interest and importance, on account of their relation to medicine, education, law and morals."

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Packard
MADE IN DETROIT U·S·A

THE WHITE

—in itself an exposition of progress

That The White is enthusiastically pronounced the final word in motor car designing and construction is not an occasion for wonder when the car is seen.

Sheer beauty of the finally-perfect streamline body harmonizes with the mechanical superiority which has always marked The White.

Possibly no one detail in a motor car has ever evoked such commendatory comment as the absorbing of the conventional back of the front seat in the center cowl—a ripple in the streamline.

This, however, is simply one of many things which blend into the complete charm of the car.

White leadership is a principle

The accomplishment of the final aim in body designing is the outgrowth of that leadership which, among other things, first introduced the mono-bloc, long-stroke, high speed motor; the logical left-side drive; the first perfected electrical system combined with the tremendous advantage of a non-stallable engine.

These fundamental mechanical improvements have been basic principles in The White for years.

WHITE DEALERS EVERYWHERE ARE EXHIBITING AND DEMONSTRATING THE DIFFERENT MODELS

THE WHITE COMPANY, Cleveland

Manufacturers of Gasoline Motor Cars, Motor Trucks and Taxicabs

Exhibiting at Transportation Building, Panama-Pacific International Exposition, San Francisco